

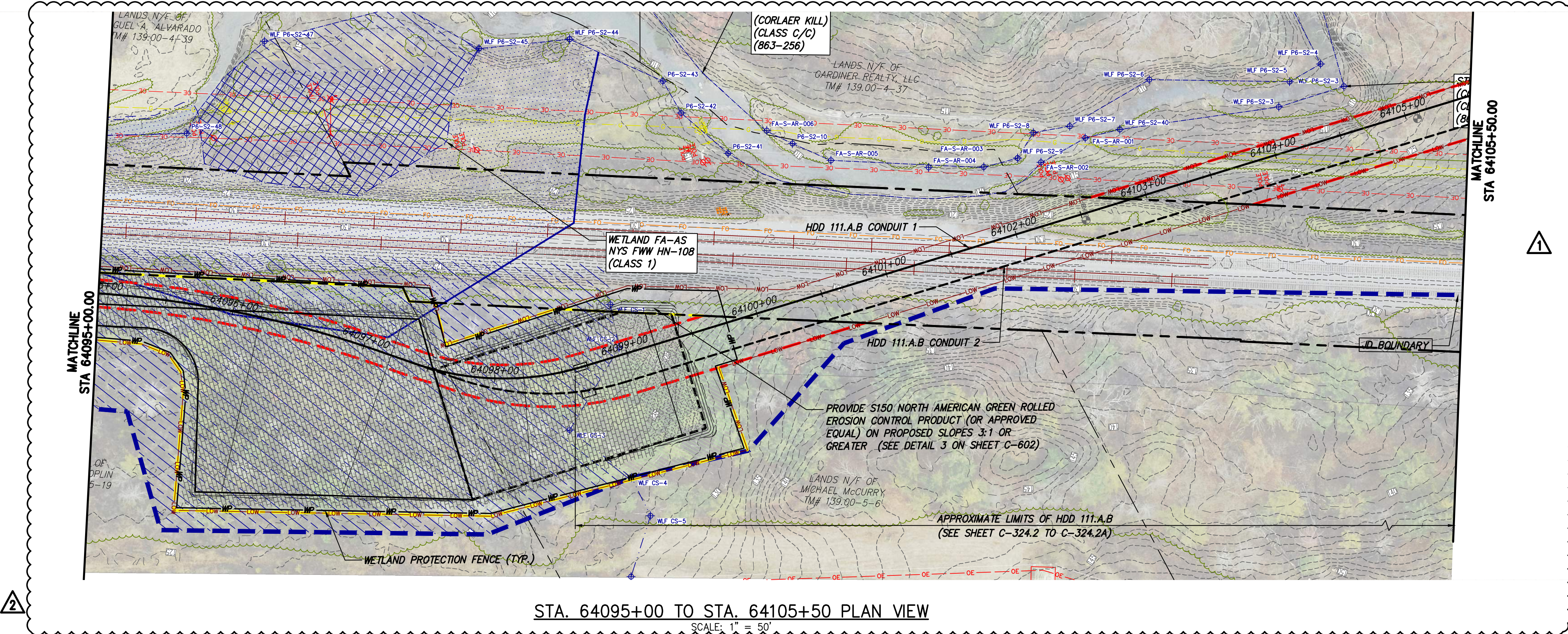
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1

2

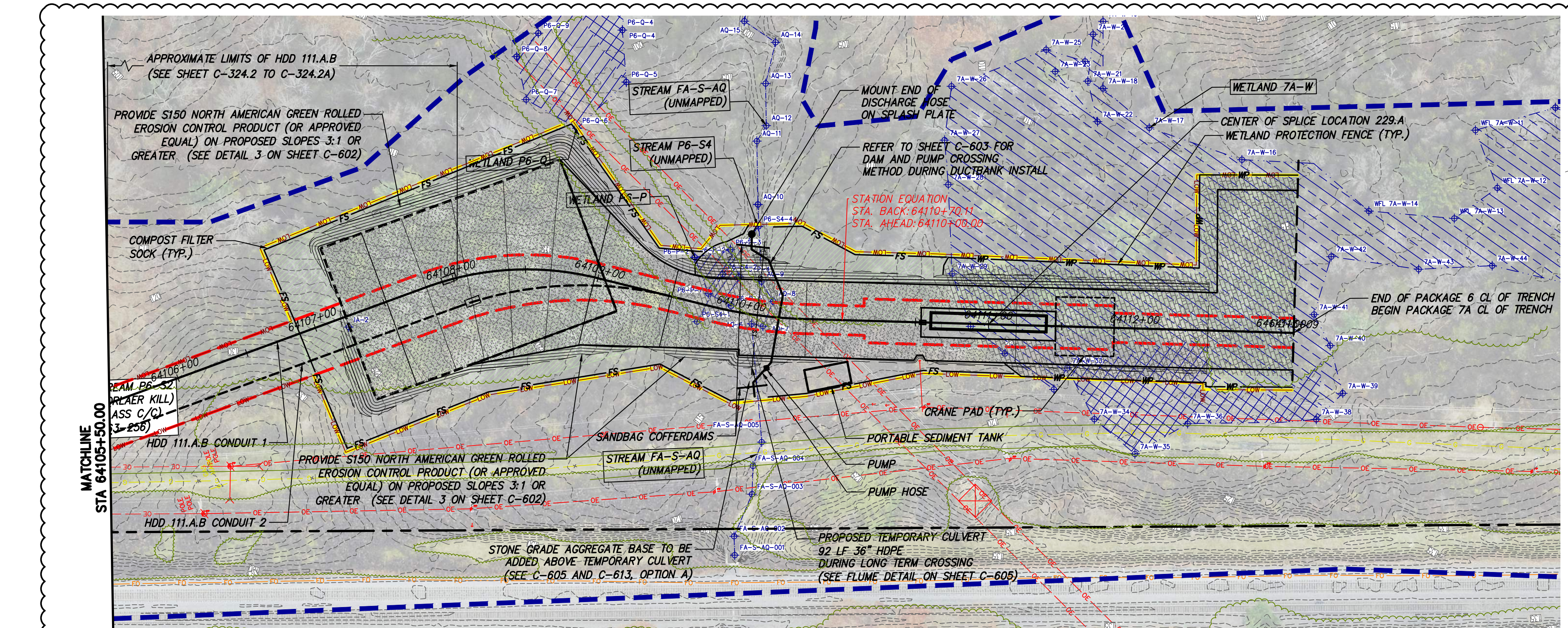
3

4



STA. 64095+00 TO STA. 64105+50 PLAN VIEW

SCALE: 1" = 50'



STA. 64105+50 TO STA. 64113+08.69 PLAN VIEW

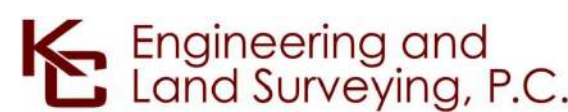
SCALE: 1" = 50'



PROJECT NO.: 21162



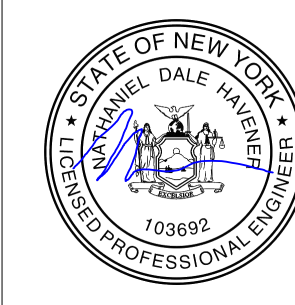
PROJECT NO.: 120174



ALTERED ON: 10/18/2024



AFFIXED ON: 09/29/2023



IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP
2	10/18/2024	NDC-0050: LEEDS ATHENS REROUTE	JR	BD
1	06/21/2024	NDC-0105: HDD TRANSITION AREA RECONCILIATION	JR	BD
0	09/29/2023	ISSUED FOR CONSTRUCTION SUBMISSION	TM/MK	NH

CHAMPLAIN HUDSON POWER EXPRESS  
SEGMENT 10 (PACKAGE 6) - SELKIRK RAIL YARD BYPASS TO CATSKILL  
EROSION AND SEDIMENT CONTROL PLAN  
STA. 64095+00 TO STA. 64113+08.69

DRAWN BY: TH/AJ DESIGNED BY: MK APPROVED BY: NH SCALE DATE: 09/29/2023

PERMIT DRAWING NO.

N/A

DRAWING NO.

C-438





CHPE LLC  
623 Fifth Avenue, 20th Floor  
New York, NY 10022

**Segment 13,14,15 (Package 8)**  
**EM&CP Appendix E Updates**

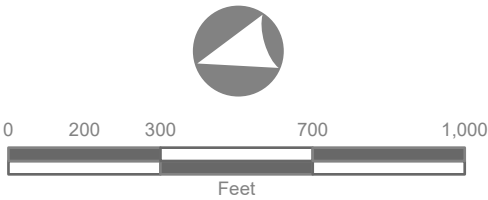
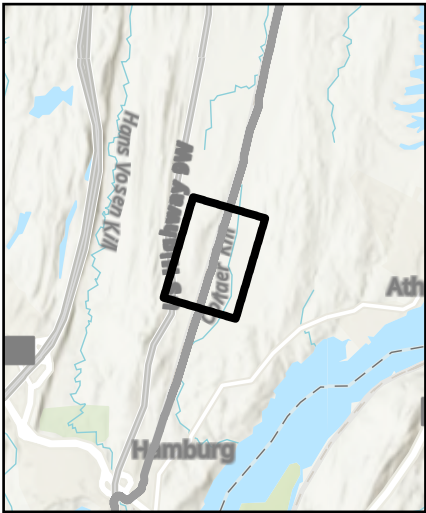


CHPE EM&CP

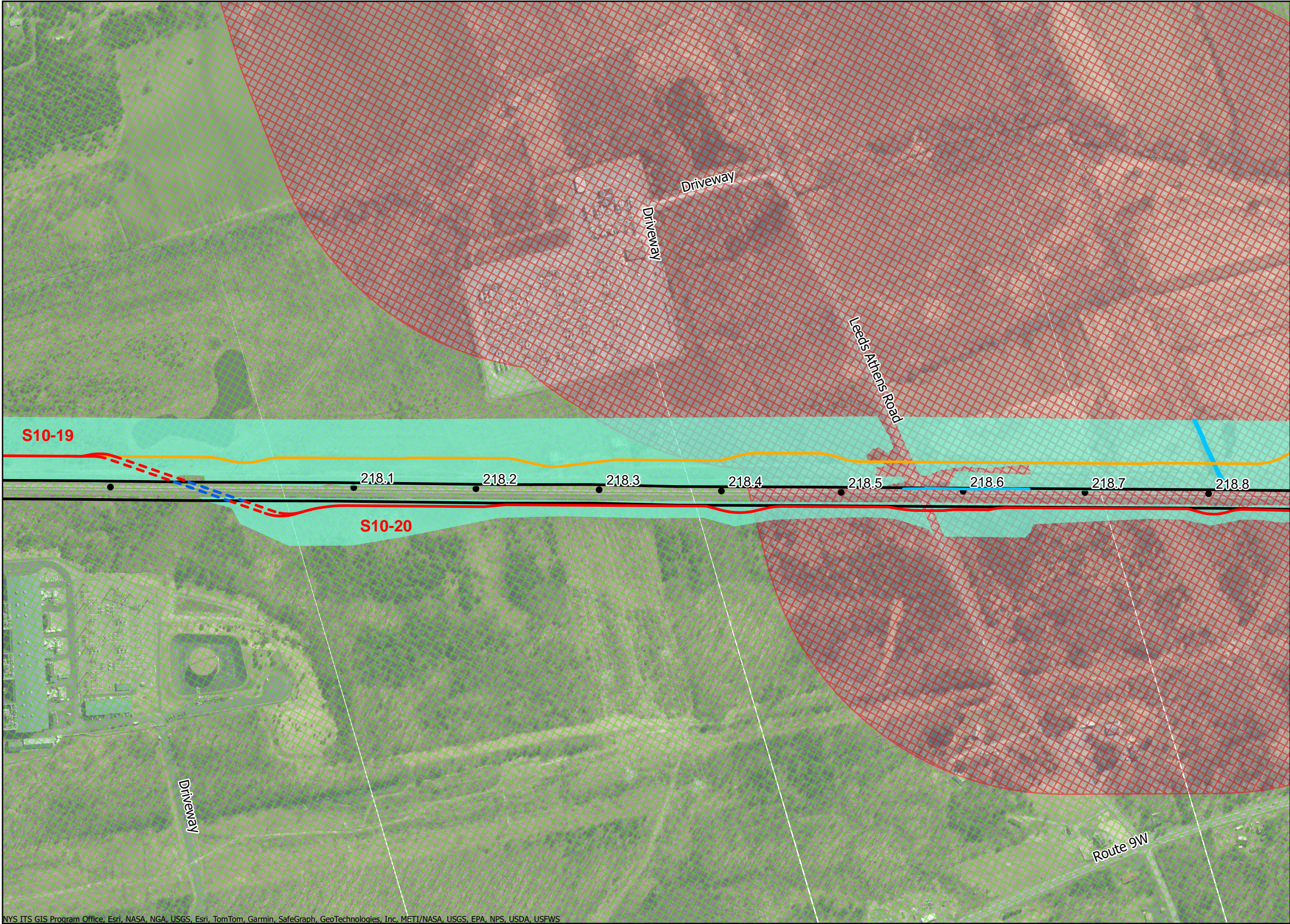
Greene County, New York

Deviation Zone Analysis

- Segment 10 Trench Excursion
- Segment 10 HDD Excursion
- Segment 10 Trench
- Segment 10 HDD
- Segment 10 Approved Trench
- Segment 10 Approved HDD
- ESA 8
- ESA 9
- Delineated Wetlands
- Delineated Streams
- Mile Post
- Deviation Zone



Prepared 10/21/2024  
Basemap NYSDOP \*2020\* map service



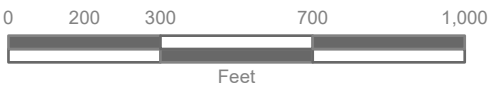
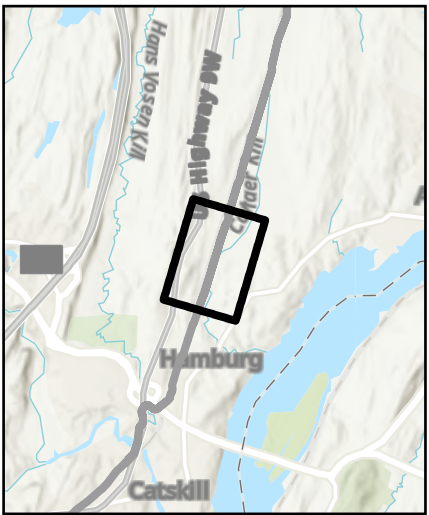


CHPE EM&CP

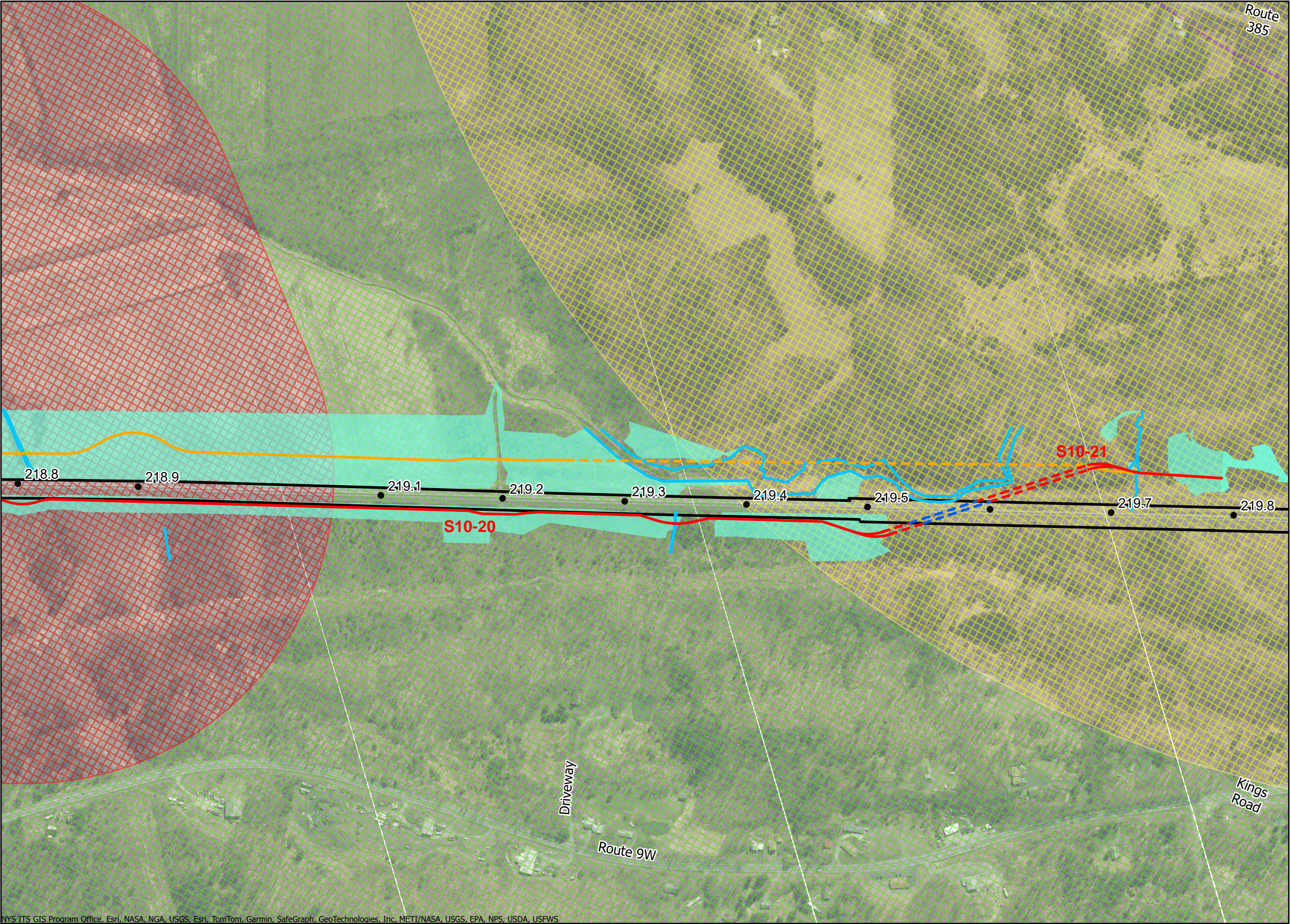
Greene County, New York

Deviation Zone Analysis

- Segment 10 Trench Excursion
- Segment 10 HDD Excursion
- Segment 10 Trench
- Segment 10 HDD
- Segment 10 Approved Trench
- Segment 10 Approved HDD
- ESA 1
- ESA 13
- ESA 8
- ESA 9
- Delineated Wetlands
- Delineated Streams
- Mile Post
- Deviation Zone



Prepared 10/21/2024  
Basemap NYSDOP \*2020\* map service





**Segment 13,14,15 (Package 8)**  
**EM&CP Appendix J**  
**HDD Design Summary Report Changes**



# HDD Report Revision Memo for HDD Design Change

HDD #: 111.A.A & 111.A.B

Date: 10/22/2024

Design Change Number(s): NDC-0050

## Revision Description:

NDC-0050 adds HDD 111.A.A & 111.A.B to cross under the CSX RR as part of a reroute to the alignment.

**For the report sections indicated below, information and analysis regarding  
HDD 111.A.A & 111.A.B are superseded by the updates in this memo:**

## Design Summary Report

Section	Section Title	Refer to IFC Submittal	Revised Herein	Notes:
1.0	Introduction	X		
2.0	Project Description		X	Table 1 updated for HDD 111.A.A & 111.A.B stationing and lengths
3.0	Background	X		
4.0	Site Conditions		X	Revisions for HDD 111.A.A & 111.A.B only
5.0	Design Summary	X		
6.0	Construction Considerations	X		
7.0	References	X		
Apx. A	Overview Map	X		
Apx. B	HDD Geotechnical Data Reports		X	Revisions for HDD 111.A.A & 111.A.B only
Apx. C	Calculations		X	Revisions for HDD 111.A.A & 111.A.B only
Apx. D	HDD Design Drawings		X	Revisions for HDD 111.A.A & 111.A.B only



## Inadvertent Release Contingency Plan

Section	Section Title	Refer to IFC Submittal	Revised Herein	Notes:
1.0	Introduction	X		
2.0	Description of the HDD Process	X		
3.0	Organization and Staffing Responsibilities	X		
4.0	Fluid Release Minimization Measures	X		
5.0	Inadvertent Release Monitoring and Notifications	X		
6.0	Inadvertent Release Response (Upload and Road Areas)	X		
7.0	Inadvertent Release Response (Wetland, railroad, and open water body areas)	X		
8.0	Drill Hole Abandonment Plan	X		
<b>9.0</b>	<b>Crossing Specific Conditions and IR Analysis</b>		<b>X</b>	<b>Updates for HDD 111.A.A &amp; 111.A.B only</b>
<b>Apx. A</b>	<b>Calculation Package</b>		<b>X</b>	<b>Updates for HDD 111.A.A &amp; 111.A.B only</b>



## **Table of Contents**

- I. Design Summary Report Revisions
  - a. Section 2.0 – Table 1 update for HDD 111.A.A & 111.A.B
  - b. Section 4.0 – Site Conditions for HDD 111.A.A & 111.A.B
  - c. Appendix B – Geotechnical Boring Logs for HDD 111.A.A & 111.A.B
  - d. Appendix C – BoreAid HDD Simulation Output for HDD 111.A.A & 111.A.B
  - e. Appendix D – HDD Design Drawings for HDD 111.A.A & 111.A.B
- II. Inadvertent Release Contingency Revisions
  - a. Section 9.0 – HDD 111.A.A & 111.A.B Crossing Specific Discussion update
  - b. Appendix A – BoreAid HDD Simulation Output for HDD 111.A.A & 111.A.B



# Champlain Hudson Power Express



***UPDATES TO***  
**HDD Design Summary Report**  
**Crossings HDD 91 to HDD 111.A**  
**in Segment 10 – Package 6**  
***FOR HDD 111.A.A & 111.A.B***  
***For Design Rev. #0 || Design Rev. Date: 10/22/2024***

**Selkirk to Catskill**  
**Greene & Albany County, New York**

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*TTR Project Number: 204-3701*

***Prepared for:***  
***Transmission Developers Inc.***  
*600 Broadway Street*  
*Albany, NY 12207*

***Prepared by:***  
***Tetra Tech Engineering and Surveying, P.C.***  
***(A New York Professional Corporation)***  
*115 Inverness Drive East, Suite 300*  
*Englewood, CO 80112*  
*(303)792-5911*



***October 2024***



## 2.0 PROJECT DESCRIPTION

Revised Table 1

Table 1: HDD Locations, Lengths, and Description

HDD #	Start Station	End Station	HDD Length, ft	Obstruction Crossed
<i>111.A.A (Conduit 1)</i>	<i>64013+48</i>	<i>64020+98</i>	<i>750</i>	<i>CSX Railroad</i>
<i>111.A.A (Conduit 2)</i>	<i>64012+79</i>	<i>64020+29</i>	<i>750</i>	<i>CSX Railroad</i>
<i>111.A.B (Conduit 1)</i>	<i>64098+68</i>	<i>64107+93</i>	<i>925</i>	<i>CSX Railroad</i>
<i>111.A.B (Conduit 2)</i>	<i>64098+69</i>	<i>64108+04</i>	<i>935</i>	<i>CSX Railroad</i>

## 4.0 SITE CONDITIONS

### 4.1.1 Project Datum and Topography

#### Text Revised

#### HDD #111.A.A

*HDD #111.A.A is 750 feet long and crosses under the CSX railway at a 19 degree angle. The surface terrain in this area is general flat throughout the path of the HDD with the entry at El. 126 feet and exit at El. 126 feet (reference datum NAVD 1988).*

#### HDD #111.A.B

*HDD #111.A.B is 925 feet long and crosses under the CSX railway at a 20 degree angle. The surface terrain in this area is hilly throughout the path of the HDD with the entry at El. 122 feet and exit at El. 118 feet (reference datum NAVD 1988).*

### 4.1.2 Geotechnical Data

#### HDD #111.A.A

*At this time, no geotechnical borings are available for HDD #111.A.A. There are two planned Geotechnical borings that will be completed prior to construction once landowner access permissions have been granted. For the purposes of the BoreAid analyses Geotechnical Boring KB-219.3 was used as it was most similar to the closest Geotechnical boring (B219.5-1) to HDD #111.A.A and it covered the full depth of the HDD profile. Boring KB-219.3 is*



*located approximately 1,150 feet north of HDD #111.A.A. KB-219.3 was performed by Kiewit on 4/20/2023 and terminated 52 feet deep. For the first 42 feet of the boring, the soil was primarily composed of fat and lean Clay before transitioning into Silt which composed the remainder of the bore path. The Geotechnical report for this HDD and test data is provided in Appendix B.*

*Based on the borings, the soil profile for the HDD #111.A.A BoreAid analyses will be divided into four [4] layers: Fat Clay (CH), Lean Clay (CL), Lean Clay (CL), and Silt (ML). The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix C.*

#### HDD #111.A.B

*At this time, no geotechnical borings are available for HDD #111.A.B. There are two planned Geotechnical borings that will be completed prior to construction once landowner access permissions have been granted. For the purposes of the BoreAid analyses Geotechnical Boring SC-4 was used because it was the closest Geotechnical boring to HDD #111.A.B. Boring SC-4 is located approximately 365 feet south of HDD #111.A.B. SC-4 was performed by AECOM on 1/28/2021 and terminated 16 feet deep. For the first 5 feet of the boring, the soil was primarily composed of Sand and Silt before transitioning into Clay which composed the remainder of the bore path. The Geotechnical report for this HDD and test data is provided in Appendix B.*

*Based on the borings, the soil profile for the HDD #111.A.B BoreAid analyses will be divided into four [4] layers: Silty Sand (SM), Silt (ML), Clay (CL), and Clay (CL). The chosen test bore did not reach the full depth of the drill profile, so for the purposes of the BoreAid analysis the final Clay layer was assumed to extend the full depth of the drill profile. The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix C.*



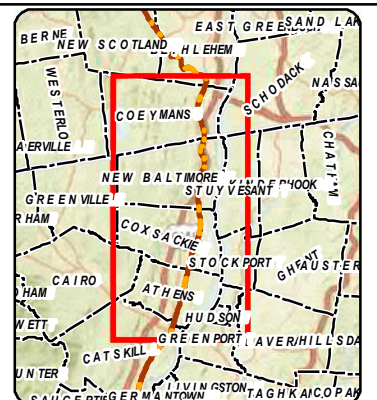
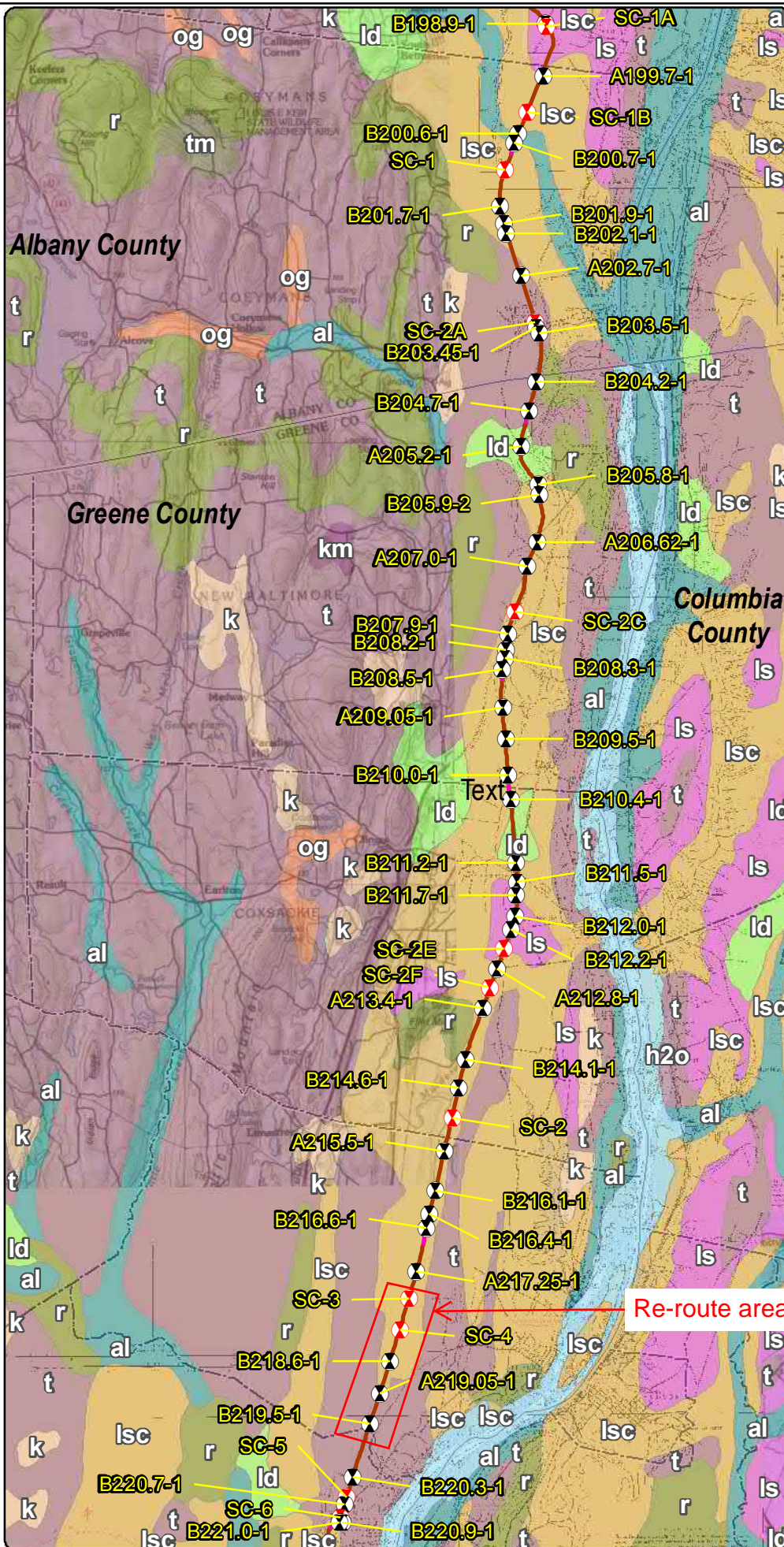
## **Appendix B**

### **Geotechnical Boring Logs Added**

## Appendix B

### Geotechnical Reports





# LEGEND

- 2021 Boring Location
- Previous (2013) Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

## Surficial Geology

- al - Recent alluvium
- h2o - Water
- k - Kame deposits
- km - Kame moraine
- ld - Lacustrine delta
- ls - Lacustrine sand
- lsc - Lacustrine silt and clay
- og - Outwash sand and gravel
- r - Bedrock
- t - Till
- tm - Till moraine



1 0.5 0 1 Miles

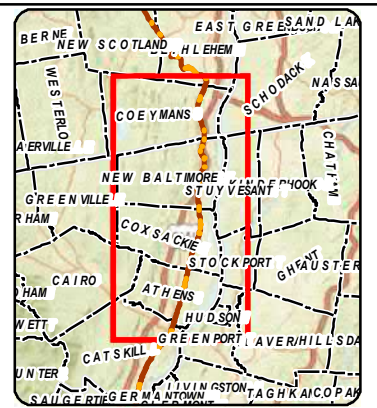
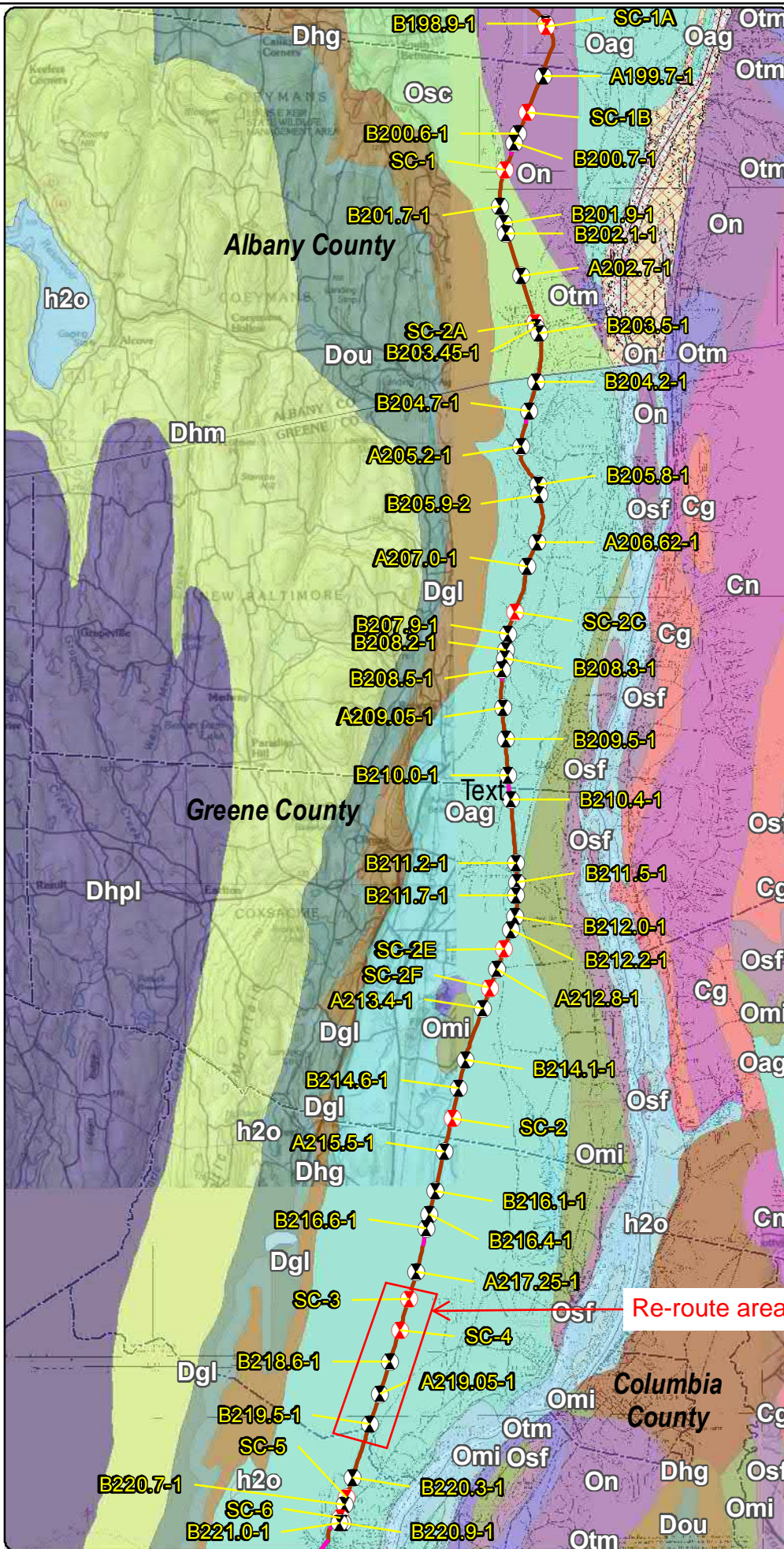


Champlain Hudson Power Express Project  
Champlain Hudson Power Express Inc.

## Surficial Geology and Geotechnical Borings Selkirk to Catskill Figure 3-10

Prepared on 5/3/2021  
by: **AECOM**





## LEGEND

- 2021 Boring Location
- Previous (2013) Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

## Bedrock Geology

- Cg - Germantown Formation
- Cn - Nassau Formation
- Dgl - Glenerie Formation
- Dhg - Port Ewen Formation
- Dhml - Undiff Lower Hamilton Group
- Dhpl - Plattekill Formation
- Dou - Onondaga Limestone
- No Label
- Oag - Austin Glen Form (graywacke, shale)
- Omi - Mount Merino Formation
- On - Normanskill Shale
- Osc - Schenectady Formation
- Osf - Stuyvesant Falls Formation
- Otm - Taconic Melange
- Q - Glacial and Alluvial Deposits
- h2o - Water

\* Schenectady Formation includes: graywacke, sandstone, siltstone, shale



1 0.5 0 1 Miles



Champlain Hudson Power Express Project  
Champlain Hudson Power Express Inc.

## Bedrock Geology and Geotechnical Borings Selkirk to Catskill Figure 4-10

Prepared on 5/18/2021

by: **AECOM**



**CHPE Segment 10 - Package 6**  
**HDD Soil Boring Coordinates and Elevations**

<b>Firm</b>	<b>Boring</b>	<b>Northing (feet)</b>	<b>Easting (feet)</b>	<b>Ground Surface Elevation (feet)</b>
TRC*	A199.7-1	1344990.8	678939.9	159.0
	A205.2-1	1317487.9	677289.6	204.6
	A206.62-1	1310345.7	678496.2	186.8
	A207.0-1	1308517.7	677770.1	179.6
	A209.05-1	1298062.1	675944.3	148.6
	A219.05-1	1247052.0	666820.5	128.8
	B198.9-1	1348887.4	679090.7	173.5
	B200.6-1	1340723.0	677093.4	96.3
	B200.7-1	1340001.8	676794.4	128.5
	B201.7-1	1335310.5	675758.1	162.1
	B201.9-1	1334029.9	676014.8	173.3
	B202.1-1	1333294.3	676182.6	168.3
	B203.45-1	1326328.9	678471.9	171.2
	B203.5-1	1325831.2	678645.3	183.2
	B204.2-1	1322268.4	678463.0	198.8
	B204.7-1	1320048.9	677891.8	207.1
	B205.8-1	1314638.7	678588.0	141.5
	B205.9-2	1313866.7	678637.8	190.3
	B207.9-1	1303512.5	676338.7	156.2
	B208.2-1	1302277.3	676188.9	152.0
	B208.3-1	1301673.4	676120.2	150.0
	B208.5-1	1300907.6	675929.0	116.7
	B209.5-1	1295695.1	676165.1	137.5
	B210.0-1	1293021.1	676353.2	109.9
	B210.4-1	1291223.1	676583.0	120.5
	B211.2-1	1286509.8	676960.2	132.6
	B211.5-1	1285068.8	677013.1	140.7
	B211.7-1	1284088.5	676965.4	141.5
	B212.0-1	1282469.0	676857.5	138.9
	B212.2-1	1281498.0	676590.5	130.8
	B214.6-1	1269721.4	672670.9	124.9
	B216.1-1	1262073.1	670916.0	127.0
	B216.4-1	1260344.1	670520.5	128.3
	B216.6-1	1259315.9	670290.2	129.8
	B219.5-1	1244816.4	666093.7	130.4
AECOM**	SC-1A	1348656.7	679220.0	176.4
	SC-2A	1326692.2	678361.5	178.9
	SC-2C	1305133.1	676877.4	160.6

**Notes:**

- Northings and Eastings are provided in NAD83 New York State Plane East Zone.

- Elevations are referenced to the NAVD88 datum.

\* TRC boring coordinates as shown in Table 1-6 in AECOM report (reference below). Boring elevations estimated from November 2021 topographic survey by Williams Aerial.

\*\* AECOM boring coordinates and elevations as shown in Table 1-6 in AECOM report.

\*\*\* Kiewit boring coordinates and elevations are noted on the boring logs.

**Reference:**

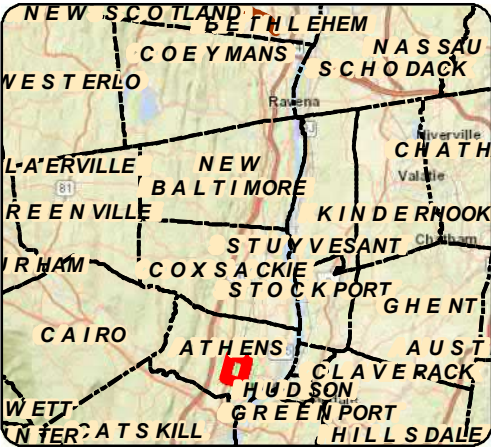
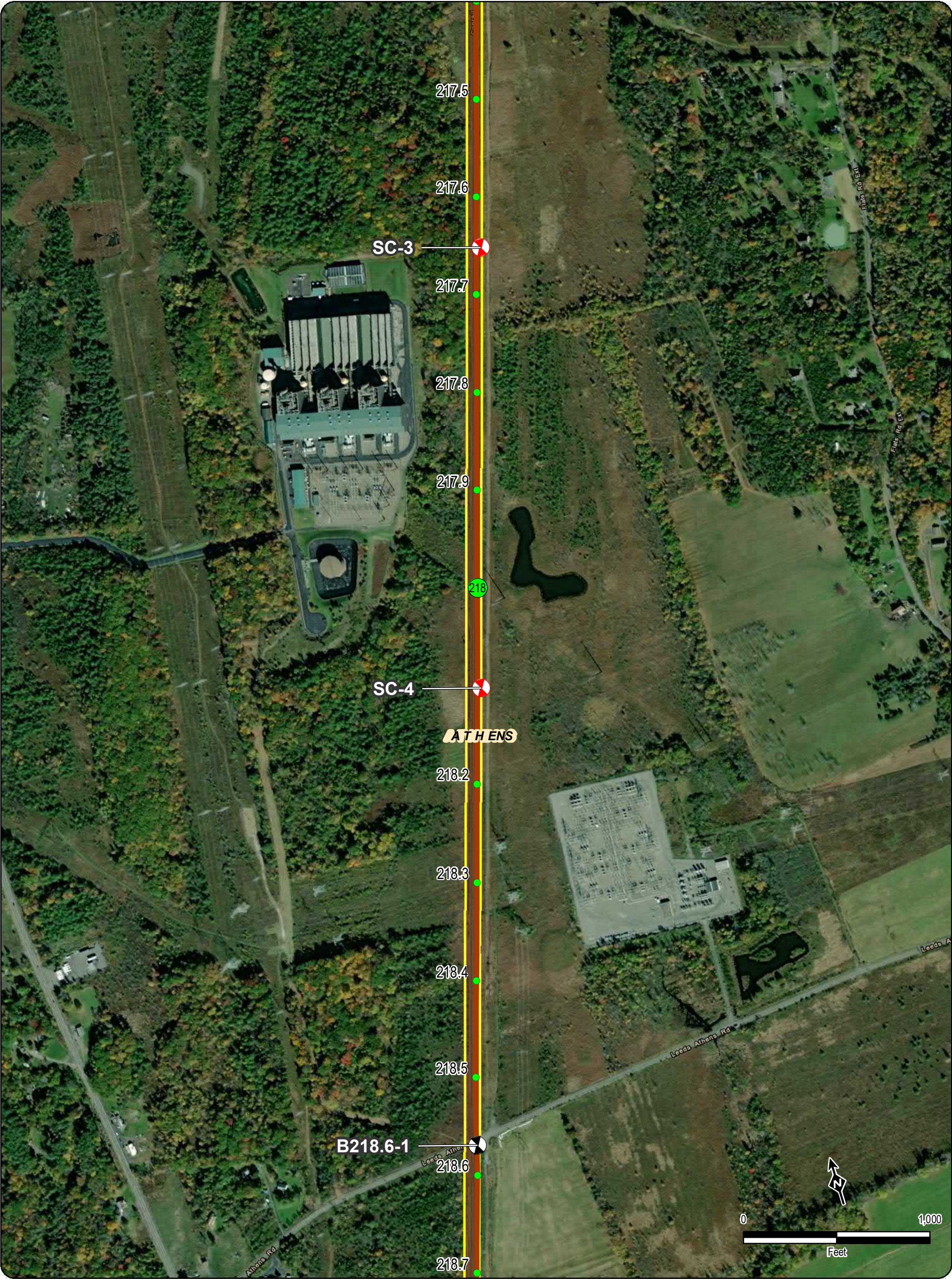
AECOM, Geotechnical Data Report, Upland Segments: Putnam Station, Washington County, to Cementon, Green County, NY, Champlain Hudson Power Express, dated May 28, 2021.



**Table 1-10: Summary of Test Borings  
Selkirk to Catskill Segment (SC)**

Boring No.	Location	Approx. Mile Post	Total Depth of Boring (ft.)	Predominant Soil Type (0'- 16')	Depth to Top of Bedrock (ft)	Type of Rock	Remarks	Depth to Water (ft.)	Northing (2)	Easting (2)	Top of Boring Elevation (1)
B216.6-1		216.62	30	SAND & GRAVEL FILL OVER SILT	-	-	-	No water observed	1259315.856	670290.248	-
SC-3	CSXT railbed	217.66	40	SILTY CLAY	-	-	-	11	1254051.128	668983.299	130.4
A217.25-1		217.25	10	SILTY CLAY	-	-	-	No water observed	1256072.876	669547.825	-
SC-4	CSXT railbed	218.10	16	SILTY CLAY	-	-	-	9	1251785.507	668306.285	124.7
B218.6-1		218.57	20	SILTY CLAY	-	-	-	No water observed	1249440.625	667582.951	-
A219.05-1		219.05	20	SILT & CLAY	-	-	-	No water observed	1247051.96	666820.541	-
B219.5-1		219.5	25	GRAVEL, SILT & CLAY	-	-	-	13.5	1244816.446	666093.665	-
B220.3-1		220.3	25	SILT & CLAY	-	-	-	2	1240785.924	664787.378	-
SC-5	CSXT railbed	220.59	40	CLAYEY SILT & SAND	32	SHALE & SANDSTONE	-	No water observed	1239310.277	664321.62	110.2
B220.7-1		220.7	16.5	GRAVEL & SILT	11.5	SANDSTONE	-	6.3	1238810.421	664167.238	-





**LEGEND**

- Certified Milepost - Tenths
- Certified Milepost
- Preferred Alternative Milepost - Tenths
- Preferred Alternative Milepost
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- 2021 Boring Location
- Previous (2013) Boring Location
- Streams/Ditches
- Railroad ROW
- Deviation Zone
- Deviation Zone Outside ROW
- Preferred Alternative Deviation Zone
- Preferred Alternative Deviation Zone Outside ROW
- Town Boundary
- Village Boundary
- State Park (OPRHP)
- Parcel Ownership
- Road Name
- Village Name

**TOWN NAME**

**Transmission Developers Inc.**

**Champlain Hudson Power Express Project**

Champlain Hudson Power Express Inc.

**BORING LOCATION PLAN**

**Selkirk to Catskill**


**Figure A-10**

Sheet 16 of 18

Prepared by: **AECOM**

5/19/2021




BORING CONTRACTOR: ADT												SHEET 1 OF 2			
DRILLER: Chris Chaillou												PROJECT NAME: CHPE -			
SOILS ENGINEER/GEOLOGIST: Chris French												PROJECT NO.: 60323056			
BORING LOG												HOLE NO.: SC-3			
LOCATION: Athens, NY MP - 216.77 (CSX Rail)												START DATE: 2/1/21			
												FINISH DATE: 2/1/21			
GROUND WATER OBSERVATIONS												OFFSET: N/A			
Water at 11' (inferred)		TYPE		Casing		Sampler		Drill Bit		Core Barrel		Drill Rig: CME LC-55			
		SIZE I.D.		Flush Joint Steel		California Modified		Tricone Roller Bit				BORING TYPE: SPT			
		SIZE O.D.		4"		2.5"		--				BORING O.D.: 4.5"			
		HAMMER WT.		140 lbs		140 lbs		3 7/8"				SURFACE ELEV.: ~130'			
		HAMMER FALL		30"		30"						LONGITUDE:			
												LATITUDE:			
D E P T H	CORING RATE MIN/FT	S A M P L E		PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr. <sup>(2)</sup>	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS		
		DEPTHS FROM - TO (FEET)	TYPE AND NO.												
1.0		0'-5'				Hand Cleared				15	SP-SW	SAND & GRAVEL	0.0': Black fine-coarse SAND, little subangular gravel; medium dense, moist		
2.0															
3.0															
4.0		3'-5'		S-1						7	ML/CL	CLAY and SILT	2.8': Black clayey SILT; medium stiff, moist, changes to brown at 4.2'		
5.0															
6.0															
7.0		5'-7'		S-2	24"	24"	8	10	13	21	1	CL/ML	CLAY and SILT	5.0': Gray and brown CLAY and silt; very stiff, moist	
8.0															
9.0															
10.0		7'-9'		S-3	24"	24"	8	10	11	12	9	CL	Silty CLAY	7.0': Gray CLAY and silt; stiff, moist	
11.0															
12.0															
13.0		9'-11'		S-4	24"	24"	6	7	7	9	7	CH	Silty CLAY	TR-2; (8.0'-8.5')	
14.0															
15.0															
16.0		11'-13'		S-5	24"	24"	3	5	5	4	1	CH	Silty CLAY	9.0': Gray silty CLAY; medium stiff, moist	
17.0															
18.0															
19.0		13'-15'		S-6	24"	24"	WOH	WOH	2	4	2	CH	Silty CLAY	11.0': Gray silty CLAY; soft, wet	
20.0															
		15'-17'		S-7	24"	24"	WOH	WOH	3	2		CH	Silty CLAY	13.0': Gray silty CLAY; very soft, wet	
											CH	Silty CLAY	15.0': SAA		
											CH	Silty CLAY	TR-3; (16.0'-16.5')		
NOTES: (1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length. (2) Correction factor: $N_{corr} = N \cdot (2.0^2 - 1.375^2) \ln. / (3.0^2 - 2.4^2) \ln. = N \cdot 0.65$ .  Soil description represents a field identification after D.M. Burmister unless otherwise noted.														The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.	
SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%															



BORING CONTRACTOR: ADT		<div>AECOM</div>										SHEET 2 OF 2			
DRILLER: Chris Chaillou												PROJECT NAME: CHPE -			
SOILS ENGINEER: Chris French												PROJECT NO.: 60323056			
												HOLE NO.: SC-3			
LOCATION: Athens, NY MP - 216.77 (CSX Rail)										BORING LOG		START DATE: 2/1/21			
												FINISH DATE: 2/1/21			
												OFFSET: N/A			
DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS		
21.0		20'-22'	S-8	24"	24"	WOH	WOH	WOH	2	27	CH	Silty CLAY	SAA		
22.0															
23.0															
24.0															
25.0															
26.0		25'-27'	S-9	24"	24"	WOR	WOH	WOH	WOH	25	CH		SAA		
27.0														TR-4; (26.0'-26.5')	
28.0															
29.0															
30.0															
31.0		30'-32'	S-10	24"	8"	10	15	26	21	57	SP	Gravelly SAND	Gray coarse SAND, some fine to medium sand, little subangular-subrounded gravel; loose, saturated		
32.0															
33.0															
34.0															
35.0															
36.0		35'-37'	S-11	24"	13"	10	14	24	29	57	SP		Gray fine to coarse SAND, some subangular-subrounded gravel, trace silt, trace cobbles; loose, saturated		
37.0														TR-5; (36.0'-36.5')	
38.0															
39.0		38'-40'	S-12	24"	7"	28	35	53	42				SP	SAND	Gray fine to medium SAND, little fine sand, trace silt; loose, saturated
40.0															
41.0													SC-3 terminated at 40' bgs, grouted to surface		
42.0															
43.0															
44.0															
45.0															
NOTES:												The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.			
Soil description represents a field identification after D.M. Burmister unless otherwise noted.															
SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%															



BORING CONTRACTOR: ADT												SHEET 1 OF 1		
DRILLER: Chris Chaillou												PROJECT NAME: CHPE -		
SOILS ENGINEER/GEOLOGIST: Chris French												PROJECT NO.: 60323056		
<div style="text-align: center;"><b>BORING LOG</b></div>												HOLE NO.: <b>SC-4</b>		
LOCATION: Athens, NY MP - 218.10 (CSX Rail)												START DATE: 1/28/21		
												FINISH DATE: 1/28/21		
GROUND WATER OBSERVATIONS												OFFSET: N/A		
Water at 9' (inferred)		TYPE	CASING		SAMPLER		DRILL BIT		CORE BARREL		DRILL RIG: CME LC-55			
		SIZE I.D.	Flush Joint Steel		California Modified		Tricone Roller Bit				BORING TYPE: SPT			
		SIZE O.D.	4"		2.5"		--				BORING O.D.: 4.5"			
		HAMMER WT.	140 lbs		140 lbs		3 7/8"				SURFACE ELEV.: <b>~125'</b>			
		HAMMER FALL	30"		30"						LONGITUDE:			
D E P T H	CORING RATE MIN/FT	S A M P L E		PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr. <sup>(2)</sup>	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS	
		DEPTHS FROM - TO (FEET)	TYPE AND NO.											
1.0		0'-5'				Hand Cleared				25	SM	TOP SOIL	0.0': Black fine-medium SAND, some silt, organics (roots); frozen	
2.0											27	ML	SILT and CLAY	0.7': Black SILT and clay, trace fine sand; medium stiff, moist
3.0										8				CL
4.0		3'-5'		S-1							7	CL	Silty CLAY	
5.0										7				CL
6.0		5'-7'		S-2	24"	24"	7	16	23		25	8	CL	
7.0										7	CL			Silty CLAY
8.0		7'-9'		S-3	24"	19"	14	22	20			17	7	
9.0										7	CL	Silty CLAY		TR-3; (12.0-12.5')
10.0		9'-11'		S-4	24"	24"	5	7	6				6	7
11.0										-	CL	Silty CLAY	Gray silty CLAY; very soft, wet	
12.0		11'-13'		S-5	24"	24"	7	6	5				7	-
13.0										-	CL	Silty CLAY	SC-4 terminated at 16', grouted to surface	
14.0		13'-15'		S-6	24"	24"	8	6	5				4	-
15.0										-	CL	Silty CLAY		
16.0		15'-17'		S-7	12"	12"	WOH	2	-				-	-
17.0										-	CL	Silty CLAY		
18.0													-	CL
19.0										-	CL	Silty CLAY		
20.0													-	CL
NOTES: (1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length. (2) Correction factor: $N_{corr} = N \cdot (2.0^2 - 1.375^2) \ln. / (3.0^2 - 2.4^2) \ln. = N \cdot 0.65$ .  Soil description represents a field identification after D.M. Burmister unless otherwise noted.												The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.		
SAMPLE TYPE:		S= SPLIT SPOON		U=SHELBY TUBE		R=ROCK CORE								
PROPORTIONS:		TRACE=1-10%		LITTLE=10-20%		SOME=20-35%		AND=35-50%						



**Table 3-10: Summary of Geotechnical Laboratory Testing of Soil Samples  
Selkirk to Catskill Segment (SC)**

Boring ID	Sample ID	Depth (ft)	USCS Symbol	% Gravel	% Sand	% Silt	% Clay	LL <sup>(1)</sup> (%)	PL <sup>(2)</sup> (%)	PI <sup>(3)</sup> (%)	Water Content	SG <sup>(4)</sup>	Org. Content (%)
SC-1A	S-3	7-9	SM	0	65.9	30.1	4	-	-	-	11.7	-	-
	S-8	20-22	SM	0	62.2	34.8	3	-	-	-	22.6	-	-
	S-10	30-32	CL	0	0.1	55.9	44	37	19	18	35.3	-	-
SC-1	S-2	5-7	CH	0	0.6	54.4	45	54	23	31	28.2	-	-
	S-4	9-11	CL	0.1	3.1	52.8	44	44	22	22	25.8	-	-
SC-2C	S-2	5-7	GP-GM	72	20	8	0	-	-	-	5.8	-	-
	S-7	15-17	GC	33	32	21	14	36	19	17	19.1	-	-
	S-9	24-29	GC-GM	49	30	16	5	15	10	5	5.0	-	-
SC-2E	S-2	5-7	CH	0	0.5	14.5	85	61	25	36	38.1	-	-
	S-5	11-13	CL	0	0.2	35.8	64	47	23	24	39.5	-	-
SC-3	S-2	5-7	CH	0	0.6	6.4	93	76	28	48	32.9	-	-
	S-8	20-22	CH	0	0	24	76	55	24	31	62.4	-	-
	S-10	30-32	GW-GM	58	37	2	3	-	-	-	7.4	-	-
SC-5	S-2	5-7	CL	11	12	62	15	28	18	10	20.7	-	-
	S-6	13-15	CL	12	12	45	31	40	21	19	24.9	-	-
SC-6	S-3	7-9	CL	0	0.1	49.9	50	49	24	25	50	-	-
	S-8	20-22	CL	0	0	37	63	49	23	26	63	-	-
	S-10	30-32	OL	0	0.1	37.9	62	43	21	22	62	-	-

Notes:

(1) LL = Liquid Limit

(2) PL = Plastic Limit

(3) PI = Plasticity Index

(4) SG = Specific Gravity

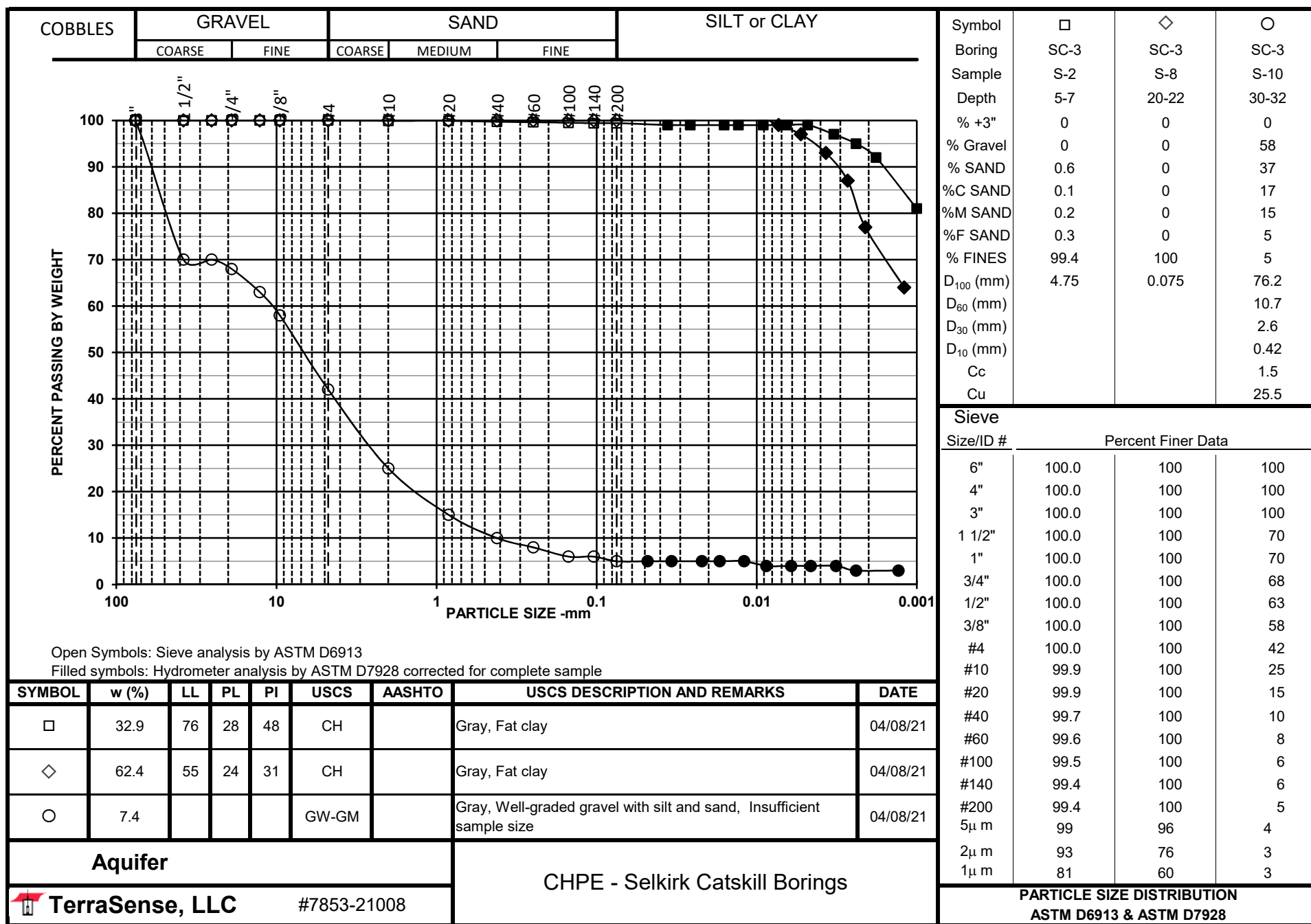


**Aquifer**  
**CHPE - Selkirk Catskill Borings**  
**LABORATORY SOIL TESTING DATA SUMMARY**

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS							REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 $\mu$ m (%)	
SC-1	S-2	5-7	28.2	54	23	31	CH	99.4	45	
SC-1	S-4	9-11	25.8	44	22	22	CL	96.8	44	
SC-1A	S-3	7-9	11.7				SM	34.1	4	
SC-1A	S-8	20-22	22.6				SM	37.8	3	
SC-1A	S-10	30-32	35.3	37	19	18	CL	99.9	44	
SC-2C	S-2	5-7	5.8				GP-GM	8		
SC-2C	S-7	15-17	19.1	36	19	17	GC	35	14	
SC-2C	S-9	24-29	5.0	15	10	5	GC-GM	21	5	
SC-2E	S-2	5-7	38.1	61	25	36	CH	99.5	85	
SC-2E	S-5	11-13	39.5	47	23	24	CL	99.8	64	
SC-3	S-2	5-7	32.9	76	28	48	CH	99.4	93	
SC-3	S-8	20-22	62.4	55	24	31	CH	100	76	
SC-3	S-10	30-32	7.4				GW-GM	5	3	
SC-5	S-2	5-7	20.7	28	18	10	CL	77	15	
SC-5	S-6	13-15	24.9	40	21	19	CL	76	31	
SC-6	S-3	7-9	29.5	49	24	25	CL	99.9	50	
SC-6	S-8	20-22	35.2	49	23	26	CL	100	63	
SC-6	S-10	30-32	34.9	43	21	22	OL	99.9	62	

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.









# TEST BORING LOG

**PROJECT:** TDI CHAMPLAIN HUDSON POWER EXPRESS

**LOCATION:** CSX RAILROAD ROW, NY

**BORING** B218.6-1

G.S. ELEV. N/A

FILE 195651

SHEET 1 OF 1

## GROUNDWATER DATA

FIRST ENCOUNTERED NR

DEPTH HOUR DATE ELAPSED TIME

DRY NR 12/5 0 HR

## METHOD OF ADVANCING BOREHOLE

a FROM 0.0' TO 10.0'

d FROM 10.0' TO 20.0'

DRILLER P. PLANTIER

HELPER M. NAGEY

INSPECTOR N/A

DATE STARTED 12/05/2012

DATE COMPLETED 12/05/2012

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
				<b>BLACK F/ GRAVEL SIZED ROCK FRAGMENTS AND SILT, SM M/C SAND (FILL)</b>	7.5	
	S-1	3 13 7 8	2.0			
5	S-2	6 5 6 6				
	S-3	7 6 6 6				
	S-4	7 9 10 12				
10	S-5	12 15 13 17		<b>LIGHT BROWN CLAY, TR SILT</b>	17.4	
15	S-6	3 4 3			31.9	
			18.5			
20	S-7	2 3 2	20.0	<b>GRAY CLAY</b>	39.5	
				<b>END OF BORING AT 20'</b>		
25						
30						
35						

NEW PROJECTS TEST BORING LOG 195651\_TDI\_CSX.GPJ SITE BLAUVELT.GDT 3/12/13

DRN. TBT  
CKD. PWK





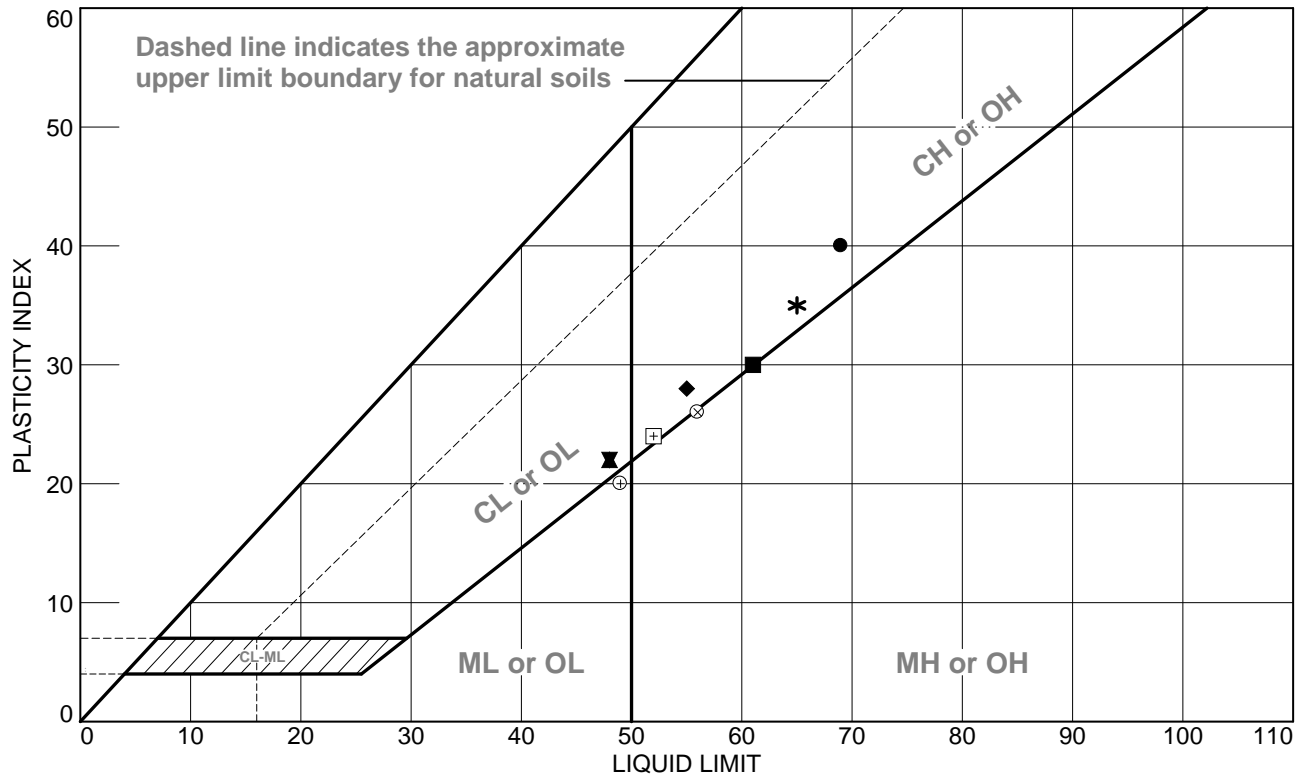
## SUMMARY OF LABORATORY TEST DATA

Project Name: TDI Champlain Hudson Power Express – CSX  
 Client Name: Transmission Developers, Inc.  
 TRC Project #: 195651

SAMPLE IDENTIFICATION			Soil Group (USCS System)	GRAIN SIZE DISTRIBUTION				PLASTICITY				Specific Gravity	Moisture Content (%)	Unit Weight (pcf)	Compressive Strength (tsf)	Organic Content (%)
Boring #	Sample #	Depth (ft)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index					
	S-4	6.0-8.0											28.1	97.6		
	S-5	8.0-10.0											31.3	-		
B218.6-1	S-1	0.0-2.0	-	-	-	-	-	-	-	-	-	-	7.5	-	-	-
	S-2	2.0-4.0	CH													
	S-3	4.0-6.0		-	-	-	-	52	28	24	-0.4		17.4	-	-	-
	S-5	8.0-10.0														
	S-6	13.5-15.0	-	-	-	-	-	-	-	-	-	-	31.9	-	-	-
	S-7	18.5-20.0	-	-	-	-	-	-	-	-	-	-	39.5	-	-	-
A219.05-1	S-1	0.0-2.0	SM	26.9	55.5	17.6		-	-	-	-	-	13.7	-	-	-
	S-3	4.0-6.0	-	-	-	-	-	-	-	-	-	-	40.5	-	-	8.5
	S-4	6.0-8.0	-	-	-	-	-	-	-	-	-	-	29.2	-	-	-



# LIQUID AND PLASTIC LIMITS TEST REPORT



## SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B216.4-1	S-5	8.0-10.0 FT	25.4	29	69	40	CH
■	B216.4-1	S-7	18.5-20.0 FT	45.4	31	61	30	CH
▲	B216.4-1	S-8	23.5-25.0 FT	36.4	26	48	22	CL
◆	B216.6-1	S-6	13.5-15.0 FT	32.9	27	55	28	CH
▼	B216.6-1	S-7	18.5-20.0 FT	33.1	26	48	22	CL
*	B216.6-1	S-8	23.5-25.0 FT	45.4	30	65	35	CH
⊕	A217.25-1	S-3, S-4, & S-5	4.0-10.0 FT	31.3	29	49	20	ML
⊕	B218.6-1	S-2, S-3, & S-5	2.0-10.0 FT	17.4	28	52	24	CH

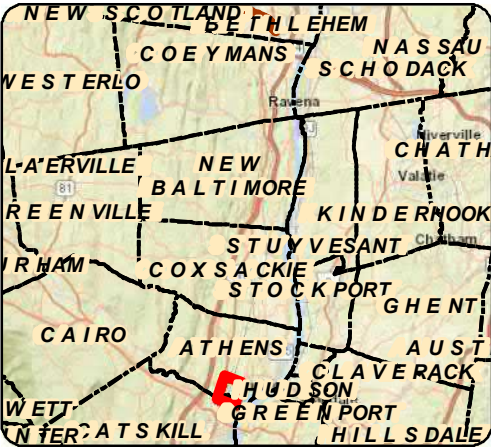
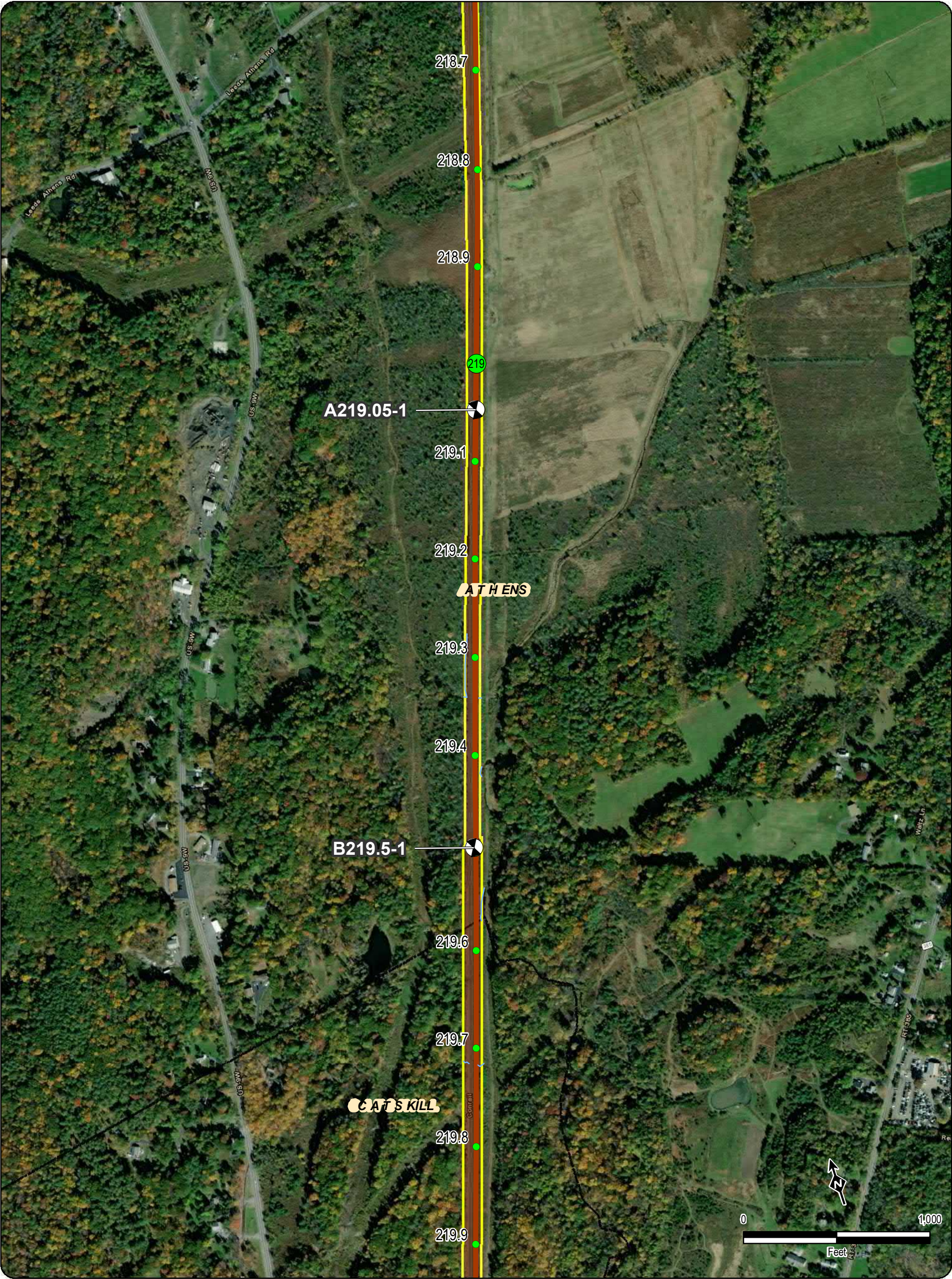
**TRC**  
**Engineers, Inc.**  
**Mt. Laurel, NJ**

**Client:** TRANSMISSION DEVELOPERS INC.  
**Project:** TDI CHAMPLAIN HUDSON POWER EXPRESS - CSX

**Project No.:** 195651

**Figure** 7





111.8

Certified Milepost - Tenths

111.8

Certified Milepost

111.8

Preferred Alternative Milepost - Tenths

135

Preferred Alternative Milepost

Terrestrial Route HVDC

Submarine Route HVDC

Terrestrial Route HVAC

Preliminary HDD Locations

Preliminary Pipe Bridge Location

2021 Boring Location

Previous (2013) Boring Location

Streams/Ditches

Railroad ROW

Deviation Zone

Deviation Zone Outside ROW

Preferred Alternative Deviation Zone

Preferred Alternative Deviation Zone Outside ROW

Town Boundary

Village Boundary

State Park (OPRHP)

Parcel Ownership

Road Name

TOWN NAME

Village Name

Transmission

Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Selkirk to Catskill

Figure A-10

Sheet 17 of 18

Prepared by:

AECOM

5/19/2021

DATA SOURCES: ESRI, NETWORK MAPPING 2010, NYSDOT, OPRHP, TDI, TRC

Y:\Projects\CHPE\Route\Consensus\_Alternative\_Routes\MXD\A11.5\_Routes\_DZ\_201909\Boring\_Locations\Maps\_for\_May\_2021\_Report\Selkirk\_to\_Catskill\_Boring\_Locations\_Mapset\_May\_2021\_Report.mxd





# TEST BORING LOG

**PROJECT:** TDI CHAMPLAIN HUDSON POWER EXPRESS

**LOCATION:** CSX RAILROAD ROW, NY

**BORING** A219.05-1

**G.S. ELEV.** N/A

**FILE** 195651

**SHEET** 1 OF 1

## GROUNDWATER DATA

FIRST ENCOUNTERED NR			
DEPTH	HOUR	DATE	ELAPSED TIME
DRY	NR	12/6	0 HR

## METHOD OF ADVANCING BOREHOLE

a	FROM	0.0'	TO	10.0'
d	FROM	10.0'	TO	20.0'

DRILLER	R. CARUSO
HELPER	C. SMART
INSPECTOR	C. POPPE
DATE STARTED	12/06/2012
DATE COMPLETED	12/06/2012

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
				<b>DARK BROWN TO BLACK M/F/C SAND, SM F/ GRAVEL, SM SILT (FILL)</b>	13.7	
	S-1	8 7 9 9	2.0			
				<b>BROWN F/M SAND, SM F/ GRAVEL TR TO SM SILT (FILL)</b>	4.0	
	S-2	5 5 6 6	4.0			
5				<b>GRAY SILT, TR CLAY</b>	40.5	
	S-3	5 5 8 8	6.0			
				<b>BROWN SILT, TR CLAY</b>	29.2	
	S-4	3 5 8 9	8.0			
10				<b>BROWN SILT</b>	30.2	
	S-5	7 14 17 23	13.5			
				<b>BROWN SILT, TR TO SM CLAY</b>	36.0	
15	S-6	6 9 10	18.5			
				<b>GRAY SILTY CLAY</b>	20.0	
20	S-7	6 3 3		<b>END OF BORING AT 20'</b>		
25						
30						
35						

NEW PROJECTS TEST BORING LOG 195651\_TDI\_CSX.GPJ SITE BLAUVELT.GDT 3/12/13

DRN. TBT  
CKD. PWK





# TEST BORING LOG

**PROJECT:** TDI CHAMPLAIN HUDSON POWER EXPRESS

**LOCATION:** CSX RAILROAD ROW, NY

**BORING** B219.5-1

G.S. ELEV. N/A

FILE 195651

SHEET 1 OF 1

## GROUNDWATER DATA

FIRST ENCOUNTERED 13.5'

DEPTH	HOUR	DATE	ELAPSED TIME

## METHOD OF ADVANCING BOREHOLE

a	FROM	0.0'	TO	10.0'
d	FROM	10.0'	TO	25.0'

DRILLER R. CARUSO

HELPER C. SMART

INSPECTOR C. POPPE

DATE STARTED 12/05/2012

DATE COMPLETED 12/05/2012

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
2.0	S-1	8 7 6 8		BLACK M/C SANDY F/C GRAVEL-SIZED ROCK FRAGMENTS (FILL)		
4.0	S-2	5 17 9 9		DARK BROWN M/F/C SAND, SM SILT, SM F/ GRAVEL (FILL)	9.1	
6.0	S-3	9 50/0.4		BROWN SILT, SM F/M SAND, TR F/ GRAVEL (FILL)	11.8	
10.0	S-4	6 7 9 13		DARK BROWN TO BLACK SILTY C/F GRAVEL, SM M/F/C SAND (FILL)		
14.9	S-5	5 8 6 13				
15.0	S-6	11 17 17			31.2	WATER TABLE DETERMINED FROM WETNESS OF SAMPLE
20.0	S-7	7 7 7		LIGHT BROWN TO BROWN CLAY, TR TO SM SILT, TR F/M SAND	28.3	
23.5						
25.0	S-8	1 2 1		GRAY SILT (THIXOTROPIC)		
				END OF BORING AT 25'		

NEW PROJECTS TEST BORING LOG 195651\_TDI\_CSX.GPJ SITE BLAUVELT.GDT 3/12/13

DRN.	TBT
CKD.	PWK





## SUMMARY OF LABORATORY TEST DATA

Project Name: TDI Champlain Hudson Power Express – CSX  
 Client Name: Transmission Developers, Inc.  
 TRC Project #: 195651

SAMPLE IDENTIFICATION			Soil Group (USCS System)	GRAIN SIZE DISTRIBUTION				PLASTICITY				Specific Gravity	Moisture Content (%)	Unit Weight (pcf)	Compressive Strength (tsf)	Organic Content (%)
Boring #	Sample #	Depth (ft)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index					
	S-4	6.0-8.0											28.1	97.6		
	S-5	8.0-10.0											31.3	-		
B218.6-1	S-1	0.0-2.0	-	-	-	-	-	-	-	-	-	-	7.5	-	-	-
	S-2	2.0-4.0														
	S-3	4.0-6.0	CH	-	-	-	-	52	28	24	-0.4		17.4	-	-	-
	S-5	8.0-10.0														
	S-6	13.5-15.0	-	-	-	-	-	-	-	-	-	-	31.9	-	-	-
	S-7	18.5-20.0	-	-	-	-	-	-	-	-	-	-	39.5	-	-	-
A219.05-1	S-1	0.0-2.0	SM	26.9	55.5	17.6		-	-	-	-	-	13.7	-	-	-
	S-3	4.0-6.0	-	-	-	-	-	-	-	-	-	-	40.5	-	-	8.5
	S-4	6.0-8.0	-	-	-	-	-	-	-	-	-	-	29.2	-	-	-





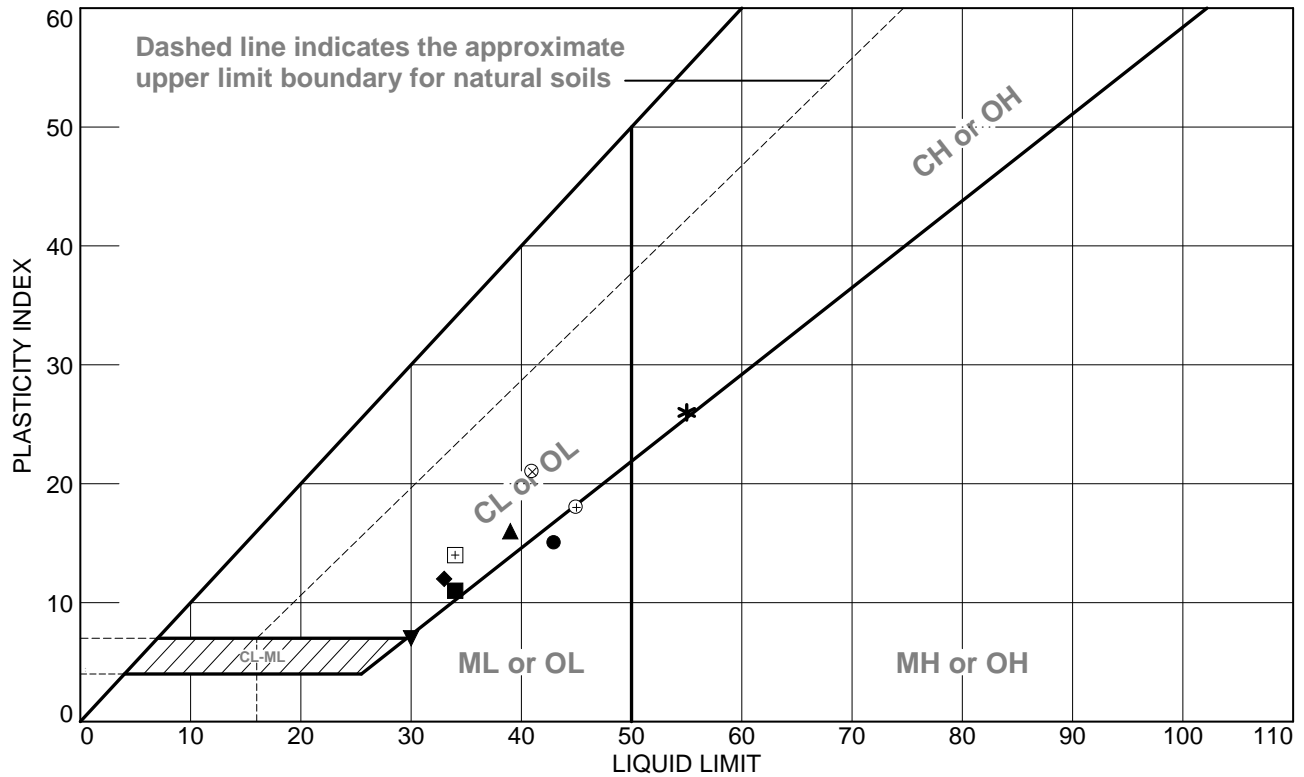
## SUMMARY OF LABORATORY TEST DATA

Project Name: TDI Champlain Hudson Power Express – CSX  
 Client Name: Transmission Developers, Inc.  
 TRC Project #: 195651

SAMPLE IDENTIFICATION			Soil Group (USCS System)	GRAIN SIZE DISTRIBUTION				PLASTICITY				Specific Gravity	Moisture Content (%)	Unit Weight (pcf)	Compressive Strength (tsf)	Organic Content (%)
Boring #	Sample #	Depth (ft)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index					
	S-5	8.0-10.0	CH/MH					56	30	26	0.0	-	30.2	-	-	-
	S-6	13.5-15.0	ML	-	-	-	-	43	28	15	0.5	-	36.0	99.3	-	-
B219.5-1	S-2	2.0-4.0	SM	16.3	62.2	21.5		-	-	-	-	-	9.1	-	-	-
	S-3	4.0-4.9	-	-	-	-	-	-	-	-	-	-	11.8	-	-	-
	S-4	6.0-8.0	GM	35.2	25.6	39.2		-	-	-	-	-	14.9	-	-	-
	S-5	8.0-10.0														
	S-6	13.5-15.0	-	0.0	3.0	14.2	82.8	-	-	-	-	2.83	31.2	99.9	-	-
	S-7	18.5-20.0	CL					34	23	11	0.5	-	28.3	-	-	-
B220.3-1	S-2	2.0-4.0	-	-	-	-	-	-	-	-	-	-	48.8	-	-	10.7
	S-3	4.0-6.0	-	-	-	-	-	-	-	-	-	-	24.0	103.8	-	-
	S-5	8.0-10.0	-	0.0	4.9	23.5	71.5	-	-	-	-	2.80	27.6	-	-	-



# LIQUID AND PLASTIC LIMITS TEST REPORT



## SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	A219.05-1	S-6	13.5-15.0 FT	36.0	28	43	15	ML
■	B219.5-1	S-7	18.5-20.0 FT	28.3	23	34	11	CL
▲	B220.3-1	S-6	13.5-15.0 FT	34.8	23	39	16	CL
◆	B220.3-1	S-7 & S-8	18.5-25.0 FT	26.9	21	33	12	CL
▼	B220.7-1	S-4 & S-5	6.0-10.0 FT	15.4	23	30	7	ML
*	B221.5-1	S-4 & S-5	6.0-10.0 FT	34.3	29	55	26	CH
⊕	B221.5-1	S-9	28.5-30.0 FT	38.2	27	45	18	CL/ML
⊕	B221.6-1	S-3, S-4, & S-5	4.0-10.0 FT	38.8	20	34	14	CL
⊗	B221.8-1	S-5	8.0-10.0 FT	40.2	20	41	21	CL

**TRC**  
**Engineers, Inc.**  
**Mt. Laurel, NJ**

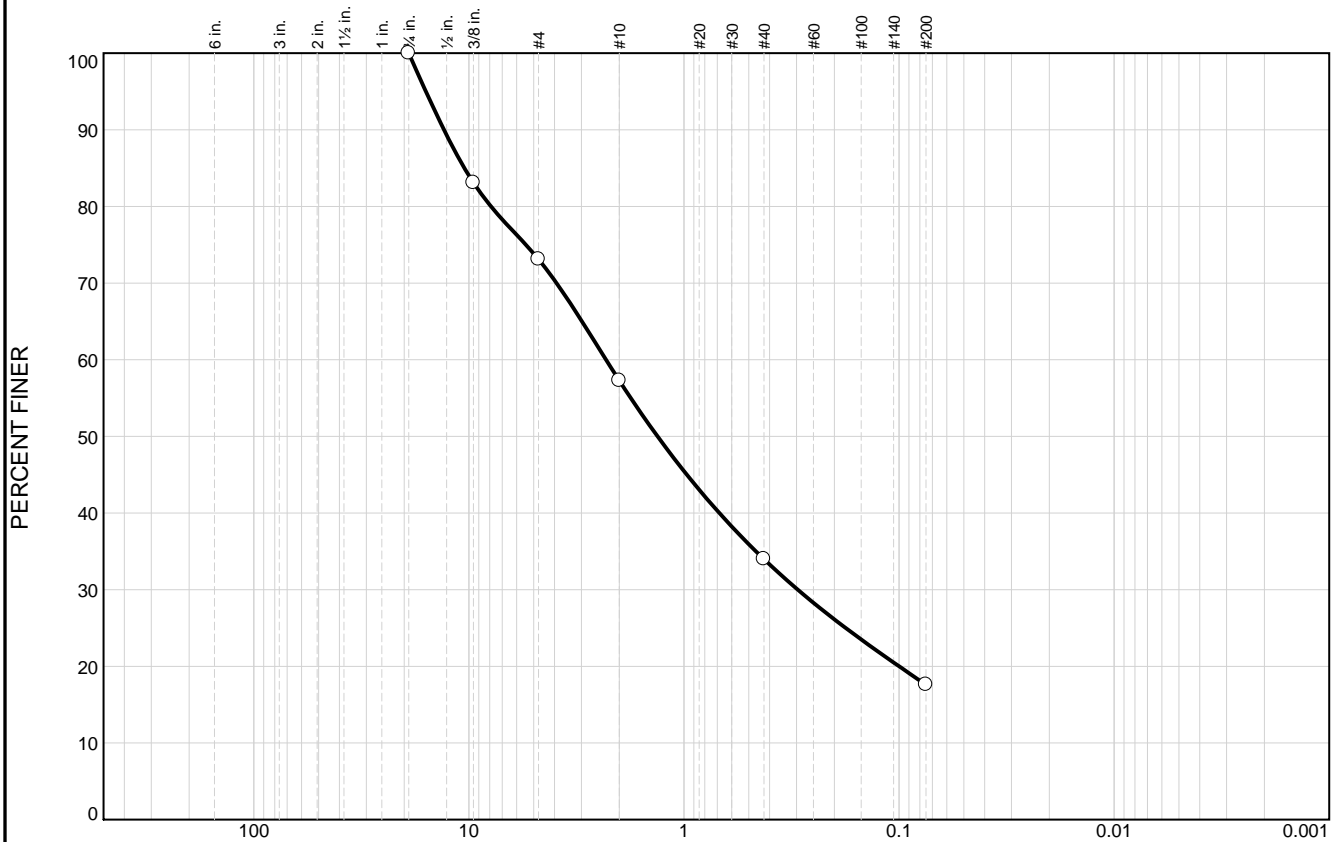
**Client:** TRANSMISSION DEVELOPERS INC.  
**Project:** TDI CHAMPLAIN HUDSON POWER EXPRESS - CSX

**Project No.:** 195651

**Figure** 8



# Particle Size Distribution Report



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt		Clay
○	0.0		0.0	26.9	15.8	23.3	16.4	17.6		
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○			10.4977	2.3041	1.3272	0.2958				

## Material Description

○ DARK BROWN TO BLACK M/F/C SAND, SM F/ GRAVEL, SM SILT

## USCS

SM

## AASHTO

**Project No.** 195651 **Client:** TRANSMISSION DEVELOPERS INC.

**Project:** TDI CHAMPLAIN HUDSON POWER EXPRESS - CSX

○ **Source of Sample:** A219.05-1 **Depth:** 0.0-2.0 FT **Sample Number:** S-1

**TRC Engineers, Inc.**

**Mt. Laurel, NJ**

## Remarks:

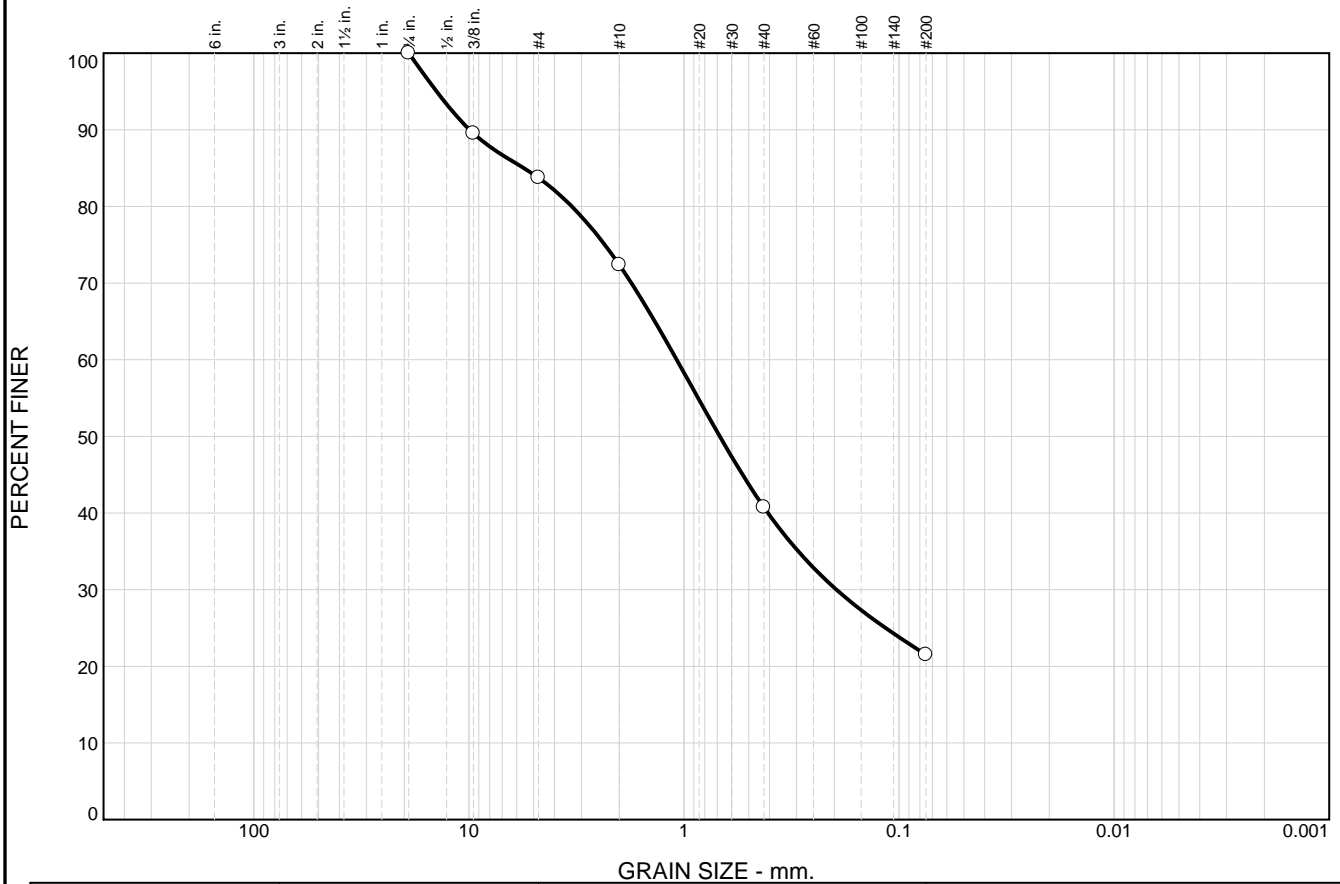
○ SAMPLE DESCRIPTION  
BASED ON VISUAL  
IDENTIFICATION AND  
LABORATORY ANALYSIS

**Figure** 109

**Tested By:** TBT 01/10/13 **Checked By:** JPB 03/12/13



# Particle Size Distribution Report

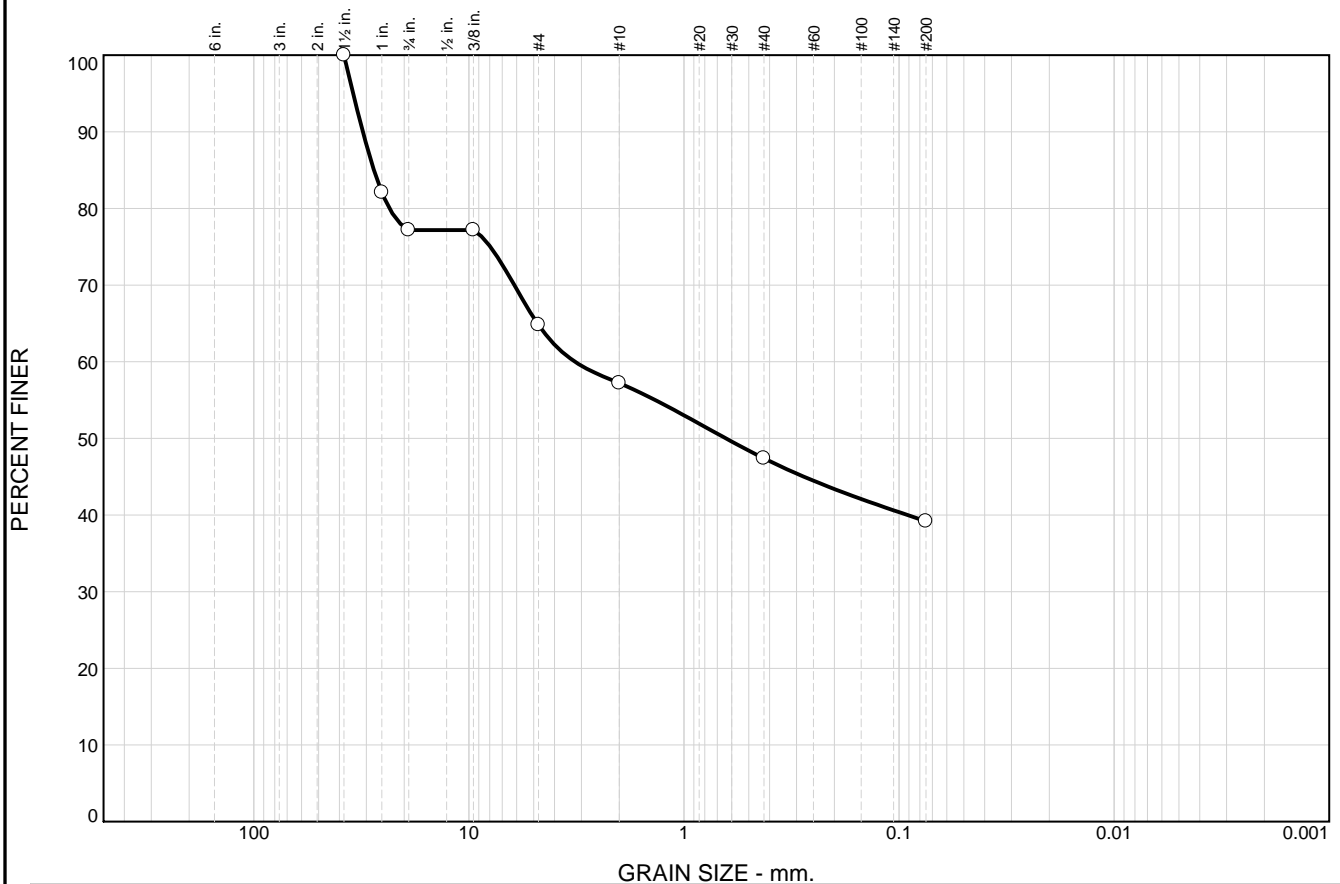


GRAIN SIZE - mm.											
% +3"		% Gravel		% Sand			% Fines				
		Coarse	Fine	Coarse	Medium	Fine	Silt		Clay		
○	0.0		0.0	16.3	11.3	31.7	19.2	21.5			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>	
○			5.5542	1.0811	0.6815	0.1955					
Material Description								USCS		AASHTO	
○ DARK BROWN M/F/C SAND, SM SILT, SM F/ GRAVEL								SM			
<b>Project No.</b> 195651 <b>Client:</b> TRANSMISSION DEVELOPERS INC. <b>Project:</b> TDI CHAMPLAIN HUDSON POWER EXPRESS - CSX								<b>Remarks:</b> ○SAMPLE DESCRIPTION BASED ON VISUAL IDENTIFICATION AND LABORATORY ANALYSIS			
○ <b>Source of Sample:</b> B219.5-1 <b>Depth:</b> 2.0-4.0 FT <b>Sample Number:</b> S-2											
TRC Engineers, Inc.								<b>Figure</b> 110			
Mt. Laurel, NJ											

Tested By: TBT 01/10/13      Checked By: JPB 03/12/13



# Particle Size Distribution Report

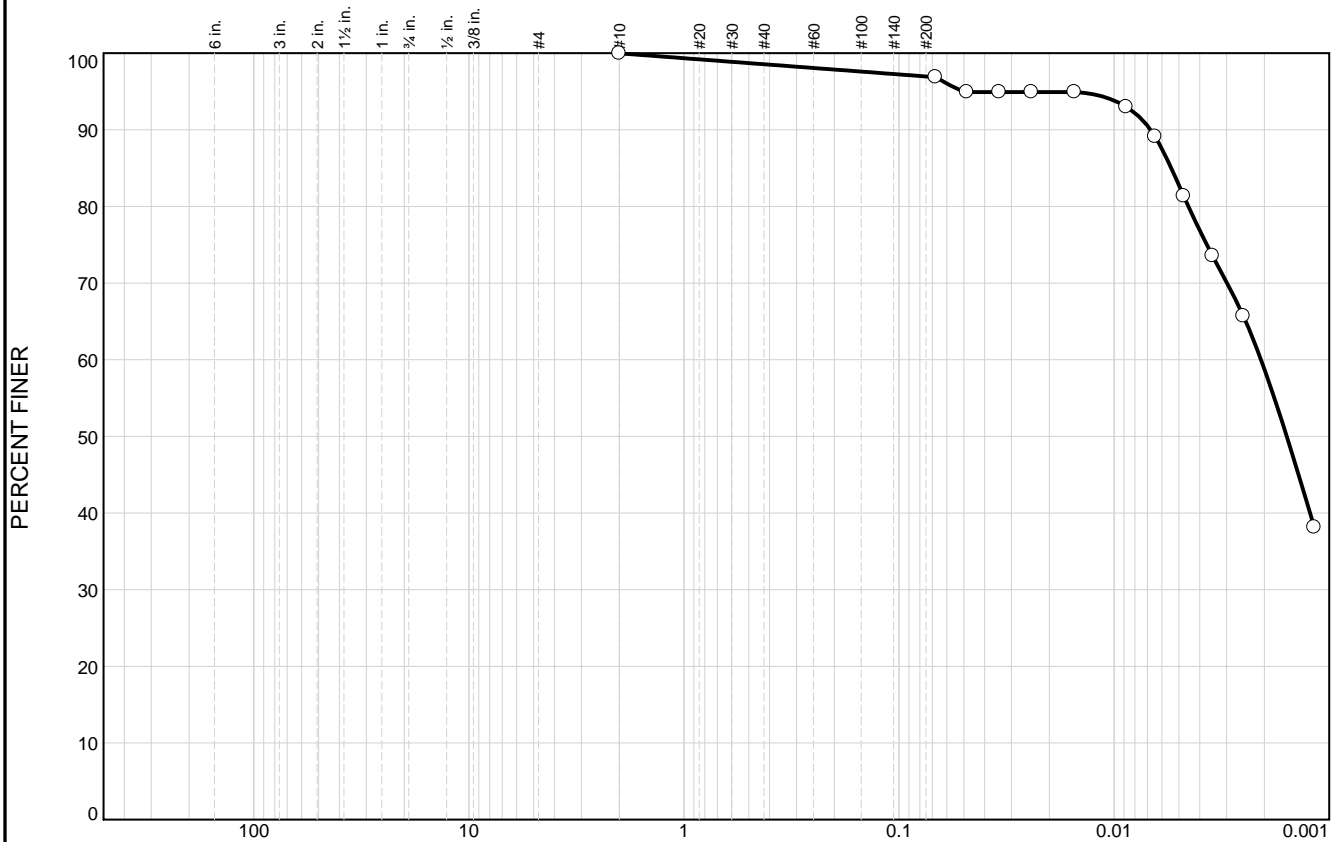


GRAIN SIZE - mm.										
% +3"		% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt		Clay	
○	0.0	22.8	12.4	7.6	9.8	8.2	39.2			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○			27.6551	3.2122	0.6383					
Material Description								USCS	AASHTO	
○ DARK BROWN TO BLACK SILTY C/F GRAVEL, SM M/F/C SAND								GM		
<b>Project No.</b> 195651 <b>Client:</b> TRANSMISSION DEVELOPERS INC. <b>Project:</b> TDI CHAMPLAIN HUDSON POWER EXPRESS - CSX								<b>Remarks:</b> ○SAMPLE DESCRIPTION BASED ON VISUAL IDENTIFICAITON AND LABORATORY ANALYSIS		
○ <b>Sample Source:</b> B219.5-1 <b>Depth:</b> 6.0-10.0 FT <b>Sample No.:</b> S-4 & S-5										
TRC Engineers, Inc.								<b>Figure</b> 111		
Mt. Laurel, NJ										

Tested By: TBT 01/10/13      Checked By: JPB 03/12/13



# Particle Size Distribution Report



GRAIN SIZE - mm.

	% +3"		% Gravel		% Sand			% Fines		
			Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
<input type="radio"/>						1.4	1.6	14.2	82.8	
<input type="checkbox"/>										
<input type="checkbox"/>										
<input checked="" type="checkbox"/>	LL	PL	D85	D60	D50	D30	D15	D10	Cc	Cu
<input type="radio"/>			0.0054	0.0021	0.0016					
<input type="checkbox"/>										

Material Description

USCS

AASHTO

☐ LIGHT BROWN TO BROWN CLAY, TR TO SM SILT, TR F/M SAND

Project No. 195651 Client: TRANSMISSION DEVELOPERS INC.

Project: TDI CHAMPLAIN HUDSON POWER EXPRESS - CSX

☐ Source of Sample: B219.5-1 Depth: 13.5-15.0 FT Sample Number: S-6

TRC Engineers, Inc.

Mt. Laurel, NJ

Remarks:

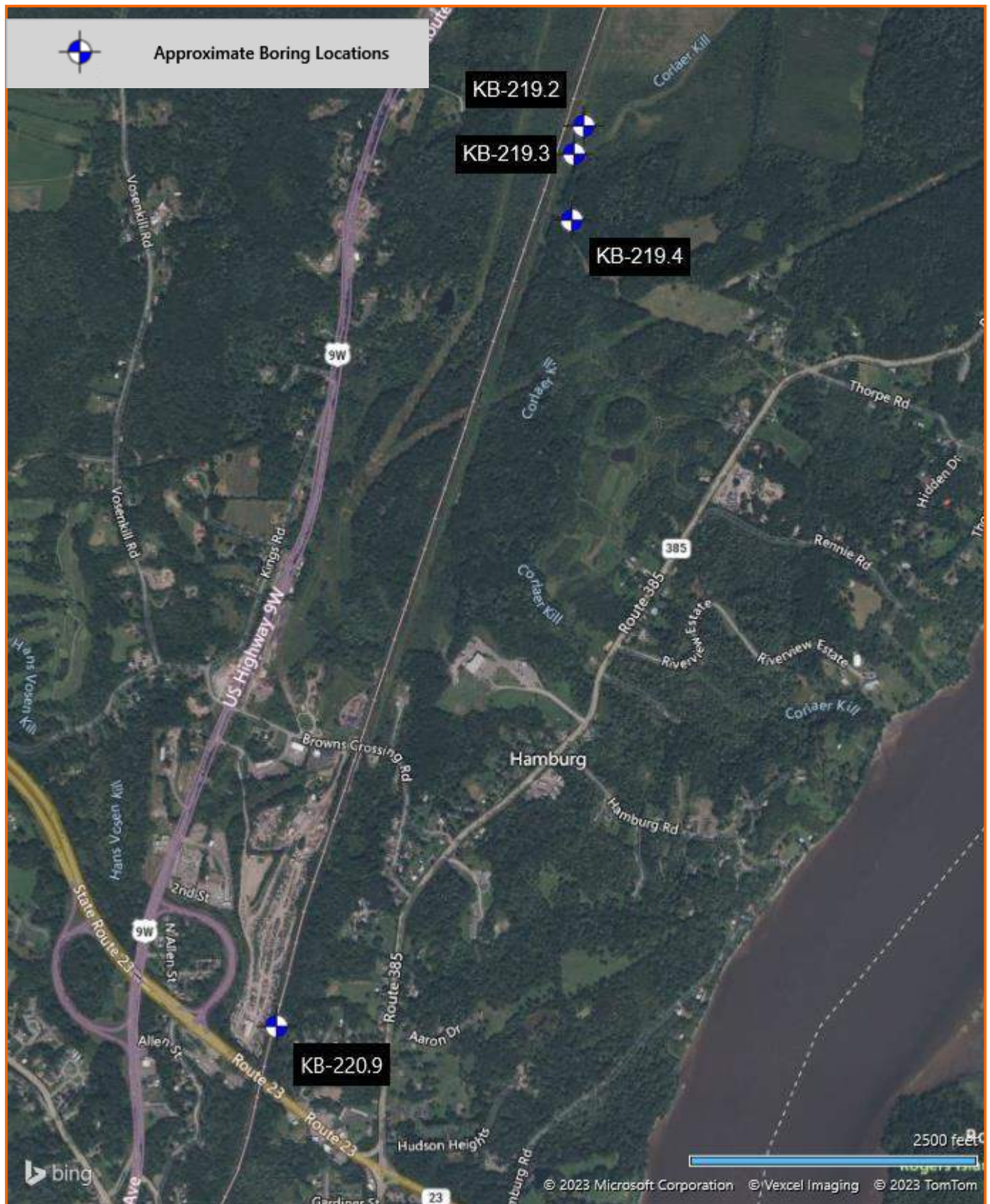
☐ SAMPLE DESCRIPTION  
BASED ON VISUAL  
IDENTIFICATION AND  
LABORATORY ANALYSIS

Figure 112

Tested By: TBT 01/08/13 Checked By: JPB 03/12/13

## EXPLORATION PLAN

Champlain-Hudson Power Express- Phase 4 HDD Borings – Package 6 and 7  
Schenectady through Selkirk, NY  
August 11, 2023 ■ Terracon Project No. JB215256J





## Geotechnical Data Report

Champlain-Hudson Power Express- Phase 4 HDD Borings – Package 6 and 7A – Rev 1  
Schenectady through Selkirk, NY  
April 25, 2023 ■ Terracon Project No. JB215256J



Rock Core – Boring KB-207.1 Run 13 through Run 15



Rock Core – Boring KB-219.4 Run 1 through Run 4

## Geotechnical Data Report

Champlain-Hudson Power Express- Phase 4 HDD Borings – Package 6 and 7A – Rev 1  
Schenectady through Selkirk, NY  
April 25, 2023 ■ Terracon Project No. JB215256J



Rock Core – Boring KB-219.4 Run 5 through Run 8



Rock Core – Boring KB-219.4 Run 9 through Run 12





# BORING LOG NO. KB-219.2

Page 1 of 3

PROJECT: Phase 4 Borings

CLIENT: Kiewit Engineering (NY) Corp  
Lone Tree, CO

SITE: Champlain to Hudson HDD Crossings

GRAPHIC LOG	LOCATION See <span>Exploration Plan</span>		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	Latitude: 42.2519° Longitude: -73.8554°								LL-PL-PI	
	DEPTH	ELEVATION (Ft.)								
	0.4	116.3								
	<b>TOPSOIL</b>									
	<b>LEAN CLAY (CL)</b> , varved silt and clay, brown, very soft to very stiff									
						12	1-1-2-3 N=3			
						18	3-4-6-9 N=10			
	5					10	4-4-9-10 N=13	27.5	42-23-19	96
						24	11-12-13-14 N=25			
						24	11-9-8-8 N=17			
	10					24	WH/18"-4			
										
	15					24	WH/12"-3-4 N=3			
	20	96.7				24	WH/24"	40.8	50-35-15	99

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
0-10 4" Casing  
10'-57" Mud Rotary

Abandonment Method:  
Boring backfilled with bentonite grout upon completion

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Hammer Efficiency Summary:  
Energy Transfer Ratio: 84.7% +/-5.0%  
Hammer Efficiency Correction (CE): 1.41  
Logged by DOL  
WH = Weight of hammer  
WR = Weight of rod

## WATER LEVEL OBSERVATIONS

No free water encountered

**Terracon**  
30 Corporate Cir Ste 201  
Albany, NY

Boring Started: 04-20-2023

Drill Rig: Diedrich D-50

Project No.: JB215256J

Boring Completed: 04-21-2023

Driller: S. Morey

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB215256J PHASE 4 BORINGS GPJ TERRACON DATATEMPLATE GDT 5/31/23


# BORING LOG NO. KB-219.2

Page 2 of 3

PROJECT: Phase 4 Borings

CLIENT: Kiewit Engineering (NY) Corp  
Lone Tree, CO

SITE: Champlain to Hudson HDD Crossings

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a>		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	Latitude: 42.2519° Longitude: -73.8554°								LL-PL-PI	
DEPTH		ELEVATION (Ft.)								
	<u><b>ELASTIC SILT (MH)</b></u> , varved silt and clay, gray, very soft <i>(continued)</i>		<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><di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Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
0-10 4" Casing  
10'-57" Mud Rotary

Abandonment Method:  
Boring backfilled with bentonite grout upon completion

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Hammer Efficiency Summary:  
Energy Transfer Ratio: 84.7% +/-5.0%  
Hammer Efficiency Correction (CE): 1.41  
Logged by DOL  
WH = Weight of hammer  
WR = Weight of rod

## WATER LEVEL OBSERVATIONS

No free water encountered

**Terracon**  
30 Corporate Cir Ste 201  
Albany, NY

Boring Started: 04-20-2023

Drill Rig: Diedrich D-50

Project No.: JB215256J

Boring Completed: 04-21-2023

Driller: S. Morey

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB215256J PHASE 4 BORINGS GPJ TERRACON\_DATATEMPLATE.GDT 5/31/23




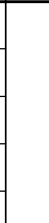



# BORING LOG NO. KB-219.2

Page 3 of 3

**PROJECT:** Phase 4 Borings

**CLIENT:** Kiewit Engineering (NY) Corp  
Lone Tree, CO

**SITE:** Champlain to Hudson HDD Crossings

GRAPHIC LOG	LOCATION See <span>Exploration Plan</span>		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	Latitude: 42.2519° Longitude: -73.8554°								LL-PL-PI	
DEPTH			ELEVATION (Ft.)							
	<u>LEAN CLAY (CL)</u> , varved silt and clay, gray, very soft to soft <i>(continued)</i>		55			8	WH/12"-4-4 N=4			
	55.0	61.7								
	<u>SANDY SILT WITH GRAVEL (SM)</u> , gray, hard, (GLACIAL TILL)					10	12-23-15-50/3" N=38			
	56.8	59.9								
<b>Boring Terminated at 56.75 Feet</b>										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
0-10 4" Casing  
10'-57" Mud Rotary

Abandonment Method:  
Boring backfilled with bentonite grout upon completion

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Hammer Efficiency Summary:  
Energy Transfer Ratio: 84.7% +/-5.0%  
Hammer Efficiency Correction (CE): 1.41  
Logged by DOL  
WH = Weight of hammer  
WR = Weight of rod

## WATER LEVEL OBSERVATIONS

No free water encountered

**Terracon**  
30 Corporate Cir Ste 201  
Albany, NY

Boring Started: 04-20-2023

Drill Rig: Diedrich D-50

Project No.: JB215256J

Boring Completed: 04-21-2023

Driller: S. Morey

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB215256J PHASE 4 BORINGS.GPJ TERRACON\_DATATEMPLATE.GDT 5/31/23


# BORING LOG NO. KB-219.3

Page 1 of 3

PROJECT: Phase 4 Borings

CLIENT: Kiewit Engineering (NY) Corp  
Lone Tree, CO

SITE: Champlain to Hudson HDD Crossings

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a>		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	Latitude: 42.2512° Longitude: -73.8557°								LL-PL-PI	
	DEPTH	ELEVATION (Ft.)								
	0.4	114.8	5  <							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
0-10 4" Casing  
10'-52" 3" Casing

Abandonment Method:  
Boring backfilled with bentonite grout upon completion

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Hammer Efficiency Summary:  
Energy Transfer Ratio: 84.7% +/-5.0%  
Hammer Efficiency Correction (CE): 1.41  
Logged by DOL  
WH = Weight of hammer

## WATER LEVEL OBSERVATIONS

**Terracon**  
30 Corporate Cir Ste 201  
Albany, NY

Boring Started: 04-19-2023

Drill Rig: Diedrich D-50

Project No.: JB215256J

Boring Completed: 04-20-2023

Driller: S. Morey

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB215256J PHASE 4 BORINGS GPJ TERRACON DATATEMPLATE GDT 5/31/23



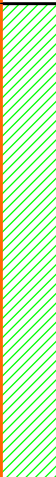
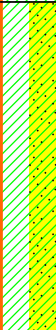
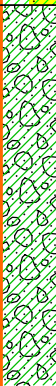
# BORING LOG NO. KB-219.3

Page 2 of 3

PROJECT: Phase 4 Borings

CLIENT: Kiewit Engineering (NY) Corp  
Lone Tree, CO

SITE: Champlain to Hudson HDD Crossings

GRAPHIC LOG	LOCATION See <span>Exploration Plan</span>		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	Latitude: 42.2512° Longitude: -73.8557°								LL-PL-PI	
DEPTH	ELEVATION (Ft.)									
	<u>LEAN CLAY (CL)</u> , varved silt and clay, gray, very soft ( <i>continued</i> )		30		X	24	WH/24"			
					X	24	WH/24" 3" Split spoon with ring samplers			
35.0	80.2		35		X	24	WH/24"	23.5	27-18-9	73
	<u>LEAN CLAY WITH SAND (CL)</u> , varved silt and clay, gray, very soft to stiff		40		X	1	6-6-6-3 N=12			
42.0	73.2		45		X	18	15-7-3-50 N=10	15.6		65
	<u>SANDY SILT (ML)</u> , gray, stiff to hard, (GLACIAL TILL)		50							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
0-10 4" Casing  
10'-52' 3" Casing

Abandonment Method:  
Boring backfilled with bentonite grout upon completion

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Hammer Efficiency Summary:  
Energy Transfer Ratio: 84.7% +/-5.0%  
Hammer Efficiency Correction (CE): 1.41  
Logged by DOL  
WH = Weight of hammer

## WATER LEVEL OBSERVATIONS

**Terracon**

30 Corporate Cir Ste 201  
Albany, NY

Boring Started: 04-19-2023

Drill Rig: Diedrich D-50

Project No.: JB215256J

Boring Completed: 04-20-2023

Driller: S. Morey

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB215256J PHASE 4 BORINGS GPJ TERRACON DATATEMPLATE GDT 5/31/23


## BORING LOG NO. KB-219.3

Page 3 of 3

PROJECT: Phase 4 Borings

CLIENT: Kiewit Engineering (NY) Corp  
Lone Tree, CO

SITE: Champlain to Hudson HDD Crossings

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 42.2512° Longitude: -73.8557°  Surface Elev.: 115.191 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
								LL-PL-PI	
DEPTH	ELEVATION (Ft.)								
 52.0	63.2				10	16-15-17-18 N=32			
<b>Boring Terminated at 52 Feet</b>									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
0-10 4" Casing  
10'-52' 3" CasingAbandonment Method:  
Boring backfilled with bentonite grout upon completionSee [Exploration and Testing Procedures](#) for a  
description of field and laboratory procedures  
used and additional data (if any).See [Supporting Information](#) for explanation of  
symbols and abbreviations.

Elevations were provided by others.

## Notes:

Hammer Efficiency Summary:  
Energy Transfer Ratio: 84.7% +/-5.0%  
Hammer Efficiency Correction (CE): 1.41  
Logged by DOL  
WH = Weight of hammer

## WATER LEVEL OBSERVATIONS

**Terracon**  
30 Corporate Cir Ste 201  
Albany, NY

Boring Started: 04-19-2023

Boring Completed: 04-20-2023

Drill Rig: Diedrich D-50

Driller: S. Morey

Project No.: JB215256J















# BORING LOG NO. KB-219.4

Page 1 of 4

PROJECT: Phase 4 Borings

CLIENT: Kiewit Engineering (NY) Corp  
Lone Tree, CO

SITE: Champlain to Hudson HDD Crossings

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a>		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	Latitude: 42.2497° Longitude: -73.8558°								LL-PL-PI	
	DEPTH	ELEVATION (Ft.)								
	0.3	120.4	5			10	1-2-3-3 N=5			32
	<b>FILL - SANDY SILT</b> , orange and brown					20	5-6-8-8 N=14			
		20				6-5-8-8 N=13				
	4.0	116.7				22	10-10-14-38 N=24	11.8		
	<b>SILTY GRAVEL WITH SAND (GM)</b> , occasional cobbles and boulders, brown, medium dense to dense, (GLACIAL TILL)					12	25-17-20-15 N=37			
						12	18-16-8-7 N=24			
	15.0	105.7	15					50/0"		
	<b>WEATHERED ROCK</b> , gray, very dense									
	20.0	100.7	20							
	<b>SHALE</b> , occasional calcite veins, unweathered, close to wide fractured with near vertical fractures, good RQD, gray						REC=100% RQD=85%			
	25.0	95.7	25							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
0-15' 4" Casing  
0-20' 3 7/8" Tricone Drill Bit  
20' -75' NQ Core Barrel

Abandonment Method:  
Boring backfilled with bentonite grout upon completion

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Hammer Efficiency Summary:  
Energy Transfer Ratio: 89.1% +/-4.4%  
Hammer Efficiency Correction (CE): 1.49  
Logged by JCH/DO

## WATER LEVEL OBSERVATIONS

No free water encountered

**Terracon**  
30 Corporate Cir Ste 201  
Albany, NY

Boring Started: 02-15-2023

Drill Rig: Mobil B-57

Project No.: JB215256J

Boring Completed: 02-16-2023

Driller: J. Swope

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB215256J PHASE 4 BORINGS GPJ TERRACON DATATEMPLATE GDT 6/5/23

## Page 2 of 4

**CLIENT: Kiewit Engineering (NY) Corp**  
**Lone Tree, CO**

[illegible]

Hammer Type: Automatic

Hammer Efficiency Summary:  
Energy Transfer Ratio: 89.1% +/-4.4%  
Hammer Efficiency Correction (CE): 1.49  
Logged by JCH/DO

Project No.: JB215256J

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB215256J PHASE 4 BORINGS.GPJ TERRACON DATATEMPLATE.GDT 6/5/23



## Page 3 of 4

**CLIENT: Kiewit Engineering (NY) Corp**  
**Lone Tree, CO**

GRAPHIC LOG	LOCATION	See Exploration Plan		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
	Latitude: 42.2497° Longitude: -73.8558°									LL-PL-PI	
	DEPTH	ELEVATION (Ft.)									
	55.0	65.7	<b>GREYWACKE</b> , occasional calcite veins, inter bedded with shale, unweathered, very close to close fractured with occasional high angled fractures, good RQD, gray	55				REC=100% RQD=78%			
	60.0	60.7	<b>SHALE</b> , occasional calcite veins, inter bedded with greywacke, unweathered, close to moderate fractured with occasional high angled fractures, excellent RQD, gray	60				REC=100% RQD=95%			
	65.0	55.7	<b>GREYWACKE</b> , occasional calcite veins, inter bedded with shale, unweathered, wide fractured with occasional high angled fractures, excellent RQD, gray	65				REC=100% RQD=100%			
	70.0	50.7	<b>GREYWACKE</b> , occasional calcite veins, unweathered, extremely close to wide fractured with occasional high angled fractures, good RQD, gray	70				REC=96% RQD=78%			
	75.0	45.7	<b>SHALE</b> , occasional calcite veins, unweathered, extremely close to moderate fractured with occasional high angled fractures, good RQD, gray	75				REC=100% RQD=70%			

Hammer Type: Automatic

Project No.: JB215256J

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB215256J PHASE 4 BORINGS.GPJ TERRACON\_DATATEMPLATE.GDT 6/5/23

# BORING LOG NO. KB-219.4

Page 4 of 4

PROJECT: Phase 4 Borings

CLIENT: Kiewit Engineering (NY) Corp  
Lone Tree, CO

SITE: Champlain to Hudson HDD Crossings

GRAPHIC LOG	LOCATION See <a href="#">Exploration Plan</a> Latitude: 42.2497° Longitude: -73.8558°  Surface Elev.: 120.73 (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS	PERCENT FINES
								LL-PL-PI	
	DEPTH ELEVATION (Ft.)								
	<b>SHALE</b> , occasional calcite veins, inter bedded with greywacke, unweathered, very close to close fractured with occasional high angled fractures, fair RQD, gray					REC=100% RQD=60%			
	80.0 40.7	80							
	<b>Boring Terminated at 80 Feet</b>								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:  
0-15' 4" Casing  
0-20' 3 7/8" Tricone Drill Bit  
20' -75' NQ Core Barrel

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Hammer Efficiency Summary:  
Energy Transfer Ratio: 89.1% +/-4.4%  
Hammer Efficiency Correction (CE): 1.49  
Logged by JCH/DO

Abandonment Method:  
Boring backfilled with bentonite grout upon completion

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were provided by others.

## WATER LEVEL OBSERVATIONS

No free water encountered

**Terracon**  
30 Corporate Cir Ste 201  
Albany, NY

Boring Started: 02-15-2023

Boring Completed: 02-16-2023

Drill Rig: Mobil B-57

Driller: J. Swope

Project No.: JB215256J

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB215256J PHASE 4 BORINGS.GPJ TERRACON\_DATATEMPLATE.GDT 6/5/23



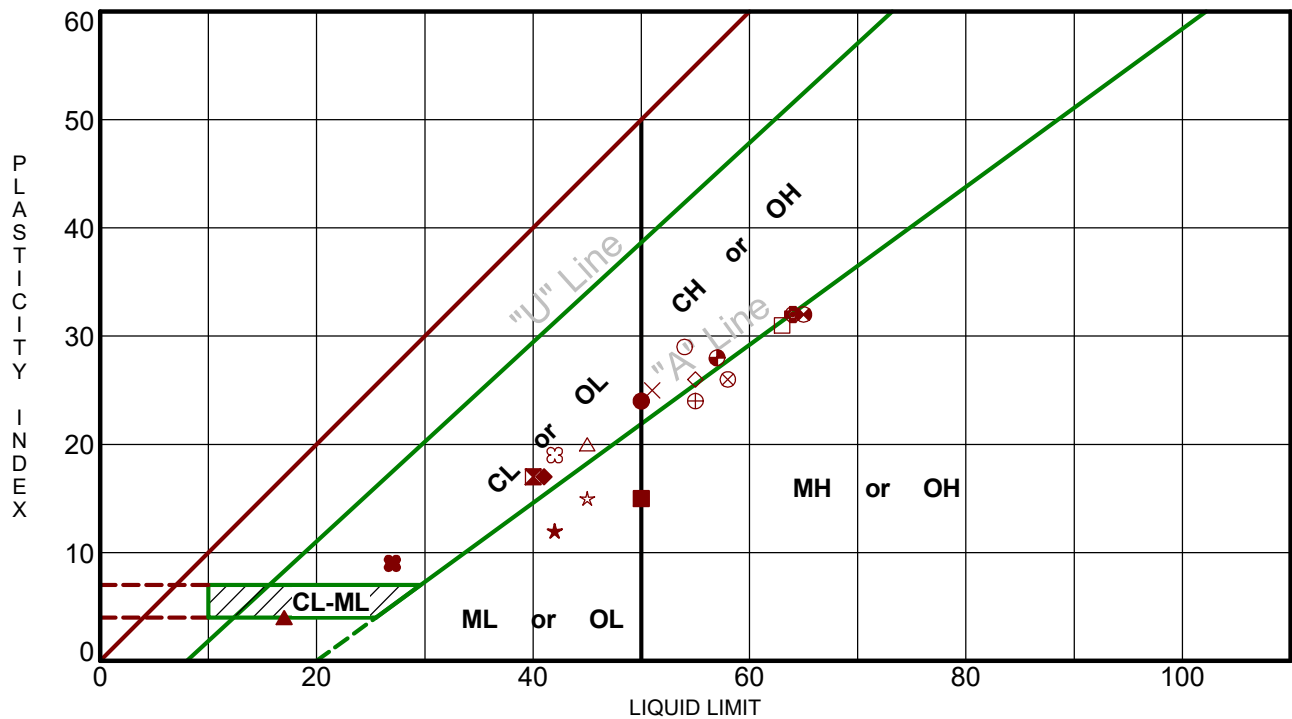
## Sheet 1 of 1

CLIENT: Kiewit Engineering (NY) Corp  
Lone Tree, CO

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. SMART LAB SUMMARY-PORTRAIT JB215256J PHASE 4 BORINGS.GPJ TERRACON\_DATA\TEMPLATE.GDT 8/10/23

# ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
● KB-206.8	4 - 6	50	26	24	87.8	CH	FAT CLAY
⊠ KB-206.8	15 - 17	40	23	17	99.4	CL	LEAN CLAY
▲ KB-206.8	35 - 37	17	13	4	37.5	SC-SM	SILTY, CLAYEY SAND with GRAVEL
★ KB-207.0	4 - 6	42	30	12	86.9	ML	SILT
⊙ KB-209.7	4 - 6	64	32	32	100.0	MH	ELASTIC SILT
⊕ KB-209.7	15 - 17	64	32	32	100.0	MH	ELASTIC SILT
○ KB-209.7	25 - 27	54	25	29	100.0	CH	FAT CLAY
△ KB-209.7	40 - 42	45	25	20	100.0	CL	LEAN CLAY
⊗ KB-211.4B	4 - 6	58	32	26	53.8	MH	SANDY ELASTIC SILT
⊕ KB-211.4B	15 - 17	55	31	24	82.0	MH	ELASTIC SILT with SAND
□ KB-211.4B	40 - 42	63	32	31	96.7	MH	ELASTIC SILT
⊕ KB-214.4	4 - 6	65	33	32	84.2	MH	ELASTIC SILT with SAND
⊕ KB-214.4	15 - 17	57	29	28	94.7	CH	FAT CLAY
★ KB-214.4	30 - 32	45	30	15	93.2	ML	SILT
⊗ KB-219.2	4 - 6	42	23	19	96.5	CL	LEAN CLAY
■ KB-219.2	20 - 22	50	35	15	99.4	MH	ELASTIC SILT
◆ KB-219.2	40 - 42	41	24	17	93.9	CL	LEAN CLAY
◇ KB-219.3	4 - 6	55	29	26	98.3	CH	FAT CLAY
× KB-219.3	15 - 17	51	26	25	95.6	CH	FAT CLAY
⊕ KB-219.3	35 - 37	27	18	9	73.3	CL	LEAN CLAY with SAND

PROJECT: Phase 4 Borings

SITE: Champlain to Hudson HDD Crossings

**Terracon**  
30 Corporate Cir Ste 201  
Albany, NY

PROJECT NUMBER: JB215256J

CLIENT: Kiewit Engineering (NY) Corp  
Lone Tree, CO

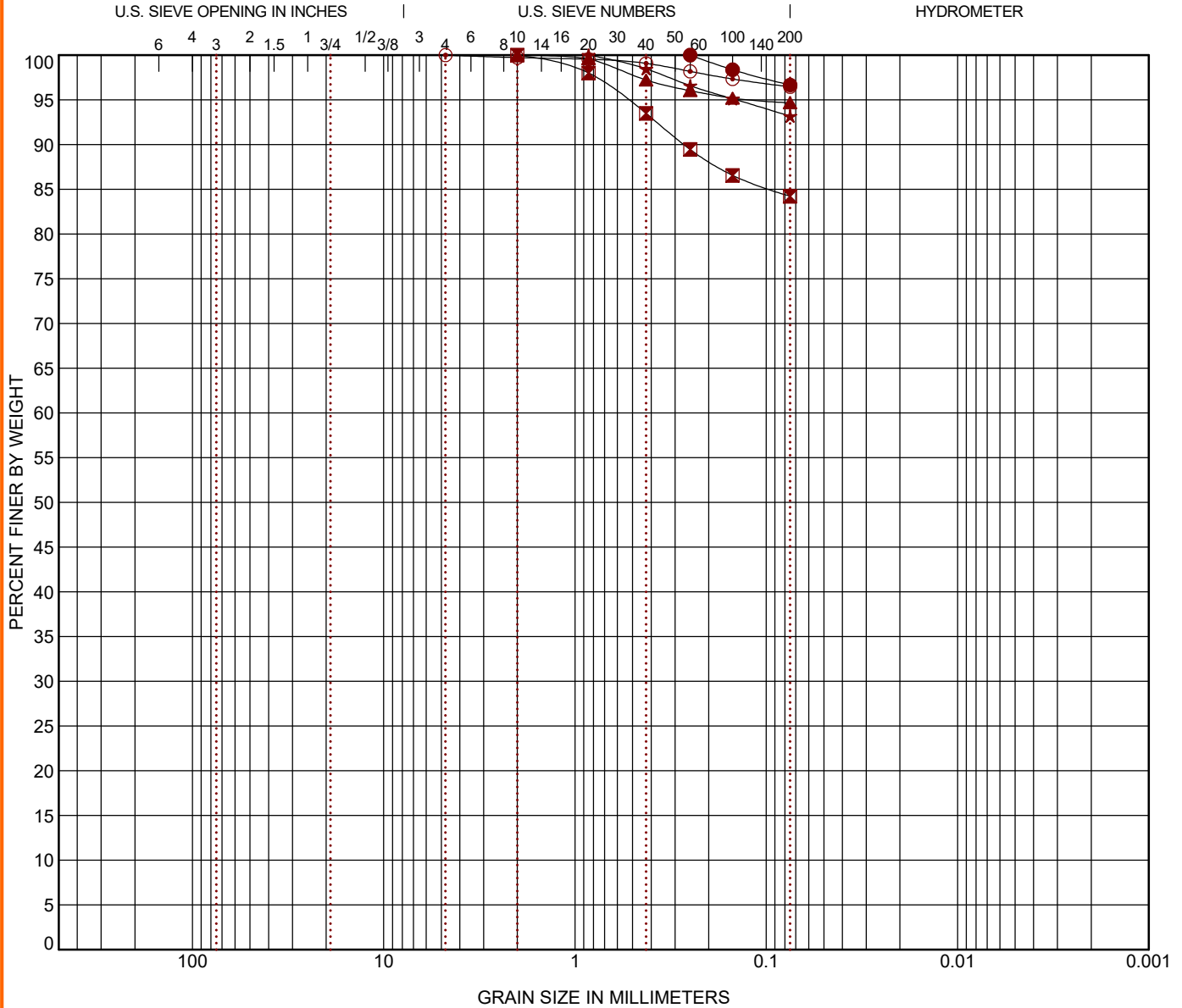
LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. ATTERBERG LIMITS JB215256J PHASE 4 BORINGS.GPJ TERRACON\_DATATEMPLATE.GDT 5/31/23



# GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 JB215256J PHASE 4 BORINGS GPU TERRACON DATATEMPLATE.GDT 5/31/23



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth (Ft)	USCS Classification				WC (%)	LL	PL	PI	Cc	Cu
● KB-211.4B	40 - 42	ELASTIC SILT (MH)				36.7	63	32	31		
☒ KB-214.4	4 - 6	ELASTIC SILT with SAND (MH)				33.7	65	33	32		
▲ KB-214.4	15 - 17	FAT CLAY (CH)				37.6	57	29	28		
★ KB-214.4	30 - 32	SILT (ML)				49.7	45	30	15		
⊙ KB-219.2	4 - 6	LEAN CLAY (CL)				27.5	42	23	19		
Boring ID	Depth (Ft)	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
● KB-211.4B	40 - 42	0.25				0.0	0.0	3.3		96.7	
☒ KB-214.4	4 - 6	2				0.0	0.0	15.8		84.2	
▲ KB-214.4	15 - 17	2				0.0	0.0	5.3		94.7	
★ KB-214.4	30 - 32	0.85				0.0	0.0	6.8		93.2	
⊙ KB-219.2	4 - 6	4.75				0.0	0.0	3.5		96.5	

PROJECT: Phase 4 Borings

SITE: Champlain to Hudson HDD Crossings

**Terracon**  
30 Corporate Cir Ste 201  
Albany, NY

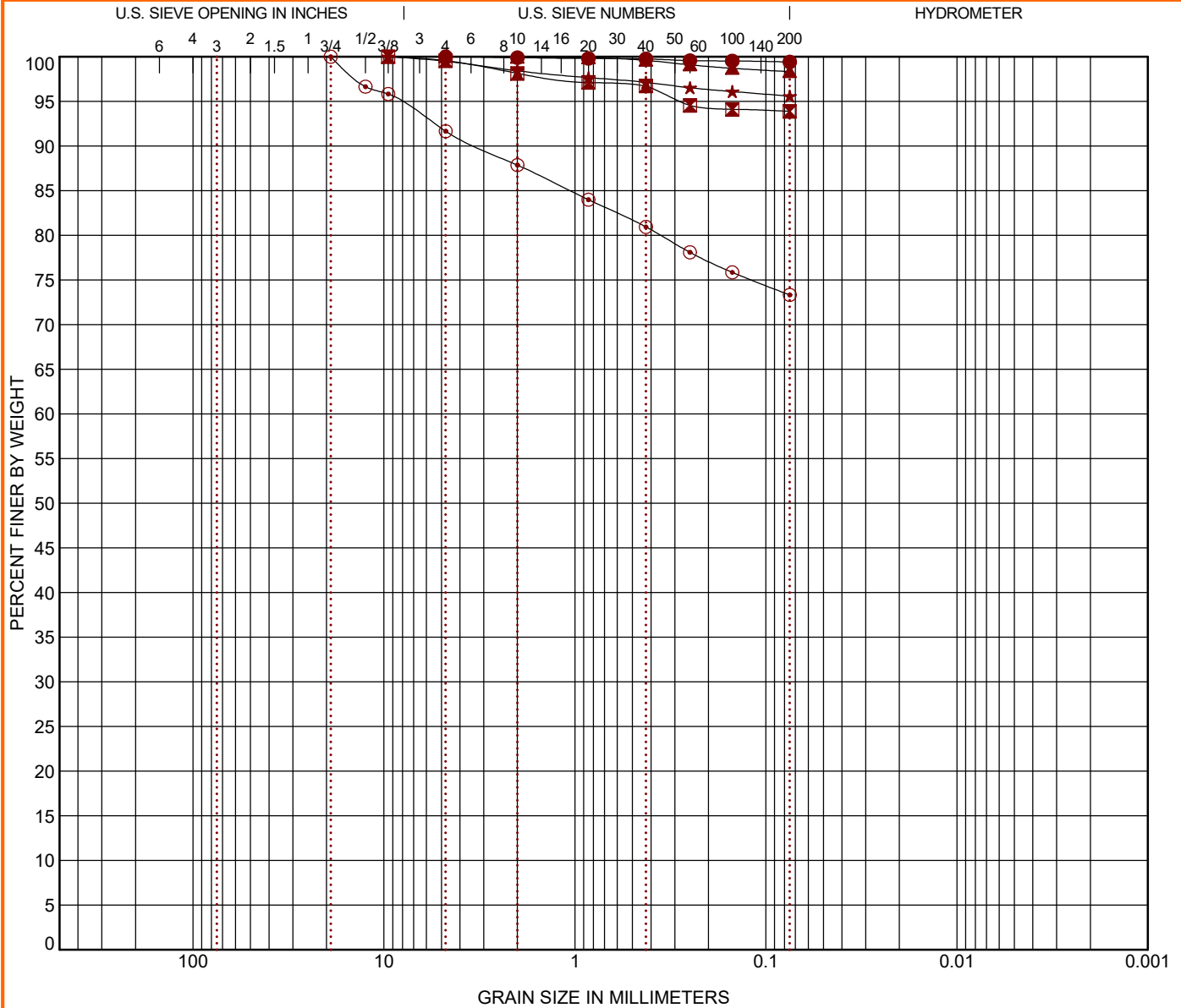
PROJECT NUMBER: JB215256J

CLIENT: Kiewit Engineering (NY) Corp  
Lone Tree, CO

# GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 JB215256J PHASE 4 BORINGS GPJ TERRACON DATATEMPLATE.GDT 5/31/23



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth (Ft)	USCS Classification				WC (%)	LL	PL	PI	Cc	Cu
● KB-219.2	20 - 22	ELASTIC SILT (MH)				40.8	50	35	15		
☒ KB-219.2	40 - 42	LEAN CLAY (CL)				43.4	41	24	17		
▲ KB-219.3	4 - 6	FAT CLAY (CH)				29.3	55	29	26		
★ KB-219.3	15 - 17	FAT CLAY (CH)				39.5	51	26	25		
⊙ KB-219.3	35 - 37	LEAN CLAY with SAND (CL)				23.5	27	18	9		
Boring ID	Depth (Ft)	D <sub>100</sub>	D <sub>60</sub>	D <sub>30</sub>	D <sub>10</sub>	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
● KB-219.2	20 - 22	4.75				0.0	0.0	0.6		99.4	
☒ KB-219.2	40 - 42	9.5				0.0	0.4	5.7		93.9	
▲ KB-219.3	4 - 6	4.75				0.0	0.0	1.7		98.3	
★ KB-219.3	15 - 17	9.5				0.0	0.5	3.9		95.6	
⊙ KB-219.3	35 - 37	19				0.0	8.3	18.3		73.3	

PROJECT: Phase 4 Borings

SITE: Champlain to Hudson HDD Crossings

**Terracon**  
30 Corporate Cir Ste 201  
Albany, NY

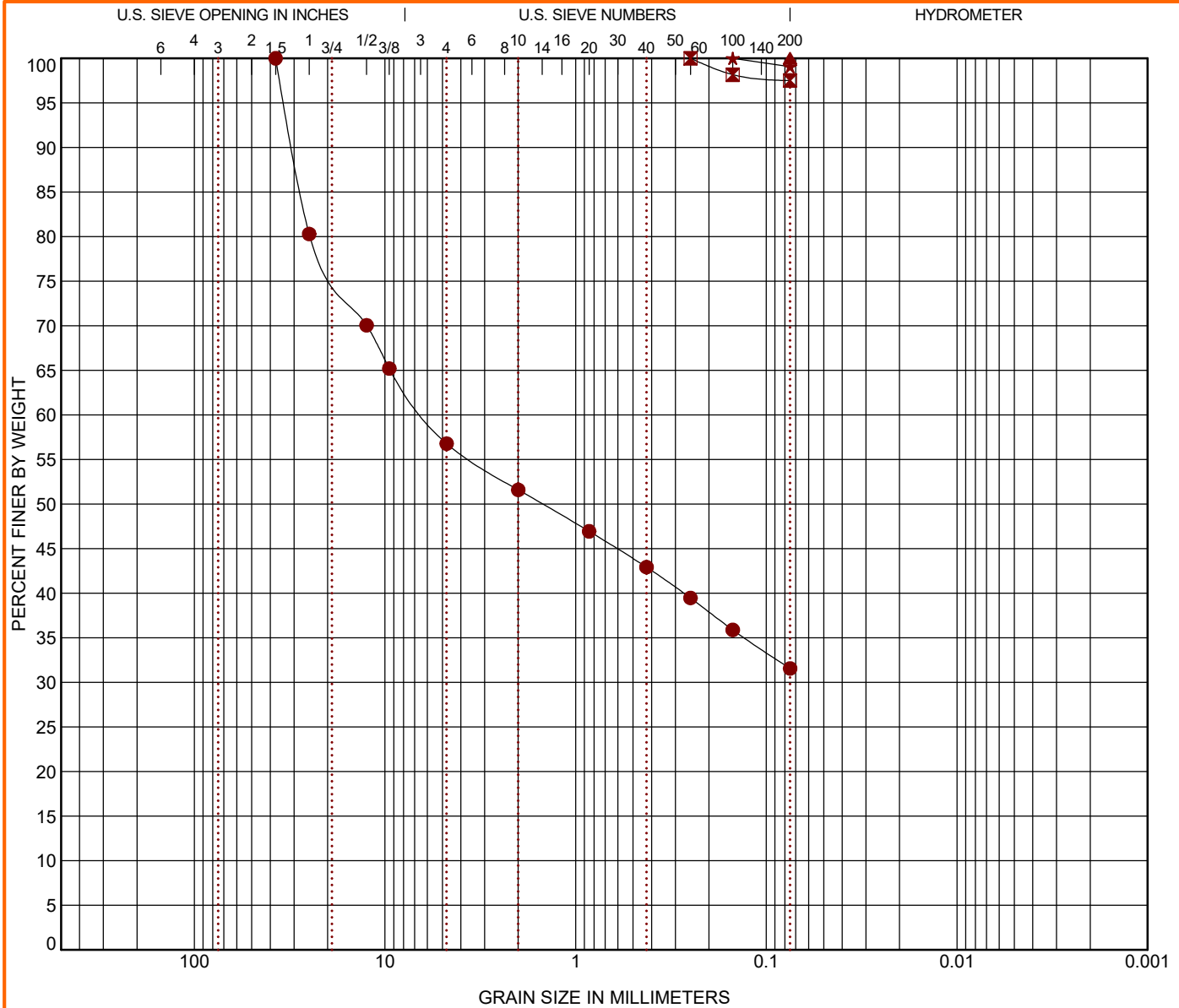
PROJECT NUMBER: JB215256J

CLIENT: Kiewit Engineering (NY) Corp  
Lone Tree, CO



# GRAIN SIZE DISTRIBUTION

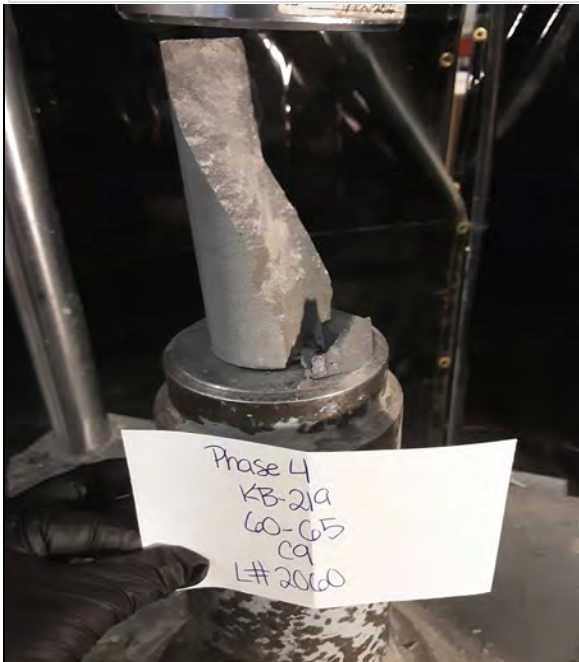
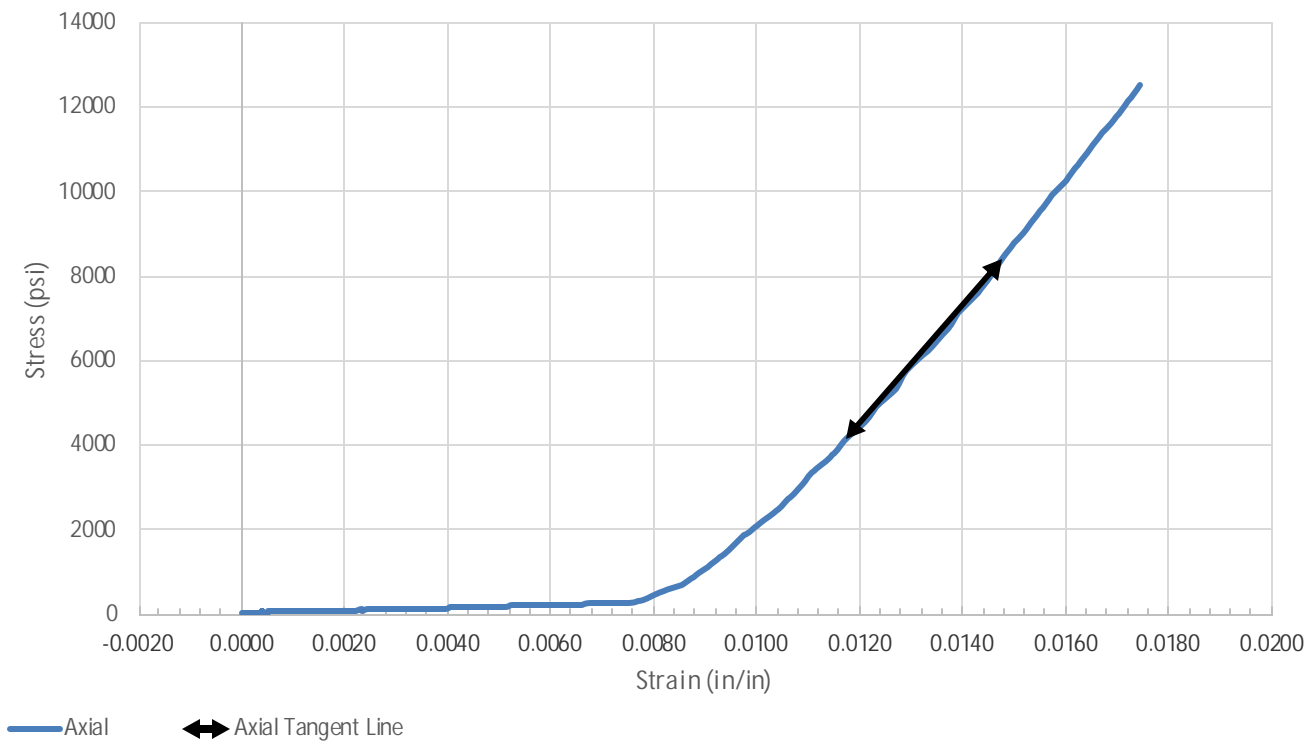
ASTM D422 / ASTM C136



<b>Client</b>	<b>Project</b>
Kiewit Engineering	Phase 4 Borings

Project No. JB215256J

ASTM D7012 Stress/ Strain Curve



SAMPLE LOCATION			
Site:	Phase 4 Borings		
Description:	Greywacke		
Boring:	KB-219.4	Depth (feet):	60.0-65.0
SPECIMEN INFORMATION			
Sample No.:	C-9	Mass (g):	564.96
Length (in.):	4.12	Diameter (in.):	1.98
L/D Ratio:	2.08	Density (pcf):	169.66
TEST RESULTS			
Failure Load (lbs):	38578		
Failure Strain (in/in):	0.020		
Unconfined Compressive Strength (psi):	12,529		
Elastic Modulus, E, (ksi):	1403		
Time of Failure (min):	03:20		
Rate of Loading (in/sec):	0.04		
Moisture Content Post-break:	0.40%		



Rock Core D7012 Method C



Client	Project
Kiewit Engineering	Phase 4 Borings

Project No. JB215256J

Equipment:	TICCS ID:
Calipers	W-44049
Scale	B-71466
Dial Indicator	C-70608
Compression (spherically seated)	C-48999

Samples were prepared and tested in accordance with ASTM D4543 and D7012. Deviations, if any, are noted below:

Notes:

Per ASTM D4543, this specimen has not met the requirements for flatness, by exceeding 0.001 inches.

Per ASTM D4543, this specimen has not met the requirements for parallelism, by exceeding 0.25°.

Per ASTM D4543, this specimen has not met the requirements for flatness, by exceeding 0.001 inches.

Per ASTM D4543 and ASTM D7012, the desired specimen length to diameter are between 2.0:1 and 2.5:1.

According to ASTM D7012 Section 8.2.1, this specimen, although not meeting all requirements of ASTM D4543 is acceptable for testing. However, the results reported may differ from results obtained from a test specimen that meets the requirements of D4543.

**Client**

Kiewit Engineering

**Project**

Phase 4 Borings

Project No. JB215256J

**Splitting Tensile Strength of Intact Rock Core Specimens, ASTM D3967**

Boring	KB-219.4	Material Description			Greywacke	
Sample No	C-9	Equipment Used			Tinius Olsen (120,000lbs)	
Depth (ft)	60.0-65.0	TICCS ID/Serial No.			C-48999, 118285	
Lab No	2060	Calibration Date			11/2/2022	
		TENSILE STRENGTH				
Lab No.	1	2	3	4	5	
Diameter (in)	1.98	1.98	1.98	1.98	—	
Length (in)	0.64	0.68	0.68	0.70	—	
Length Diameter Ratio	0.32	0.34	0.34	0.35	—	
Rate of Loading	0.0064	0.0068	0.0068	0.0070	—	
Moisture Condition	0.43%	0.43%	0.43%	0.43%	—	
Maximum Applied Load (lbf)	4851	6229	4557	4142	—	
Splitting Tensile Strength (psi)	2438.3	2946.8	2155.8	1903.5	—	
		TENSILE STRENGTH				
Lab No.	6	7	8	9	10	
Diameter (in)	—	—	—	—	—	
Length (in)	—	—	—	—	—	
Length Diameter Ratio	—	—	—	—	—	
Rate of Loading	—	—	—	—	—	
Moisture Condition	—	—	—	—	—	
Maximum Applied Load (lbf)	—	—	—	—	—	
Splitting Tensile Strength (psi)	—	—	—	—	—	



Client: Terracon Consultants, Inc.	Project No: GTX-316884
Project: Champlain-Hudson Power Express	
Location: ---	
Boring ID: KB-219.4	Sample Type: cylinder
Sample ID: ---	Test Date: 03/09/23
Depth : 60'-65'	Test Id: 707603
Test Comment: ---	Tested By: tlm
Visual Description: ---	Checked By: smd
Sample Comment: ---	

## Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
KB-219.4	---	60-65 ft	1	0.2	0.2	0.20	
			2	0.3	0.4	0.35	
			3	0.3	0.4	0.35	
			4	0.2	0.2	0.20	
			5	0.3	0.4	0.35	
			Average CAIs			0.29	
			Average CAI *			0.77	
CERCHAR Abrasiveness Index Classification					Low abrasiveness		

### Notes

Test Surface: Saw Cut  
 Moisture Condition: As Received  
 Apparatus Type: Original CERCHAR  
 Stylus Hardness: Rockwell Hardness 40/42 HRC  
 Stylus Displacement Relative to Rock Fabric:  
     Styli 1-3: Normal; Styli 4-5: Parallel  
 \* CAI = (0.99 \* CAIs) + 0.48  
 CAIs = CERCHAR index for smooth (saw cut) surface  
 CAI = CERCHAR index for natural surface  
 Comments:



## **Appendix C**

### **BoreAid Calculations Revised**

## Appendix C

### BoreAid HDD Simulation Output





## Generated Output



**WARNING:** The accuracy of the data obtained by the BoreAid® system is highly dependent upon accurate data gathering, data input and proper use of the software. Vermeer is not responsible for that information. BoreAid® data is not intended to replace the need for future on-site utility locating, measuring and verification procedures, which are essential for accurate placement of new underground installations and avoidance of existing utilities.

### CALL YOUR ONE-CALL SYSTEM FIRST



**WARNING:** Always contact your local One-Call system before the start of your digging project. The BoreAid® system is intended to be used with other utility locating methods, such as the use of the One-Call system and the exposing of existing utilities by potholing.

Locate utilities before drilling. Call 811 (U.S. only) or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.

Before you start any digging project, do not forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call Systems International, contact the appropriate utility companies or national regulating authority to locate and mark the underground installations. If you do not call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or experience job delays.

OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

## Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 05-24-2024 End Date: 09-10-2024
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 10 (Package 6) Conduit 1 HDD 111.A.A DWG C-324.1



## Input Summary

Start Coordinate	(0.00, 0.00, 125.79) ft
End Coordinate	(750.00, 0.00, 125.63) ft
Project Length	750.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

## Soil Summary

Number of Layers: 4

Soil Layer #1 USCS, Sand (S), SM

Depth: 1.00 ft

Unit Weight: 15.6618 (dry), 17.7639 (sat) [lb/US (liquid) gallon]

Phi: 30.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #2 USCS, Silt (M), ML

Depth: 6.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 10.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

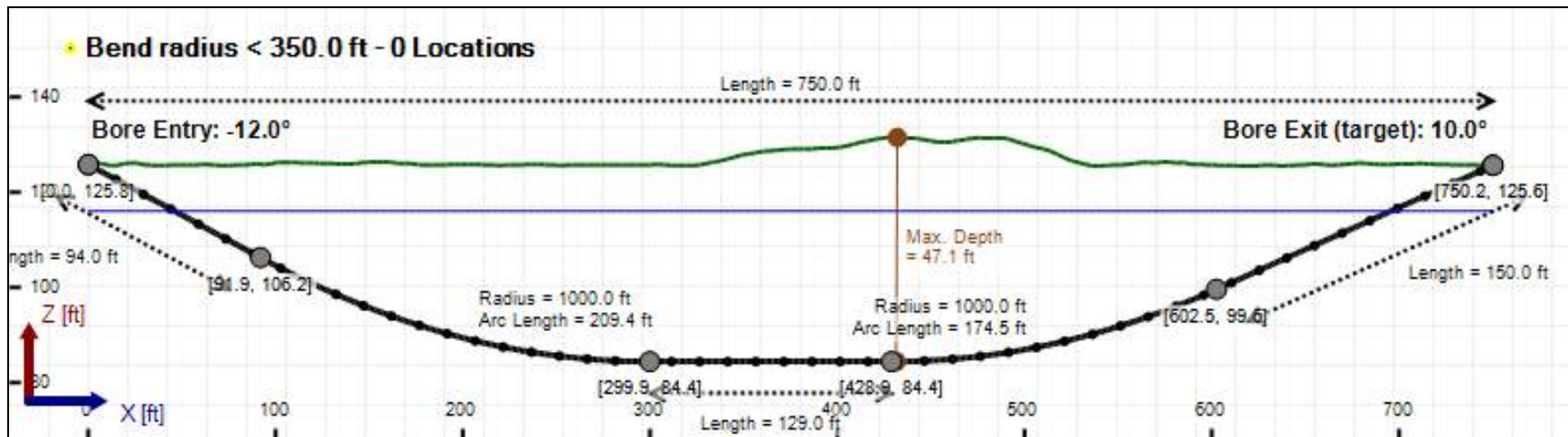
Soil Layer #4 USCS, Clay (C), CL

Depth: 30.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

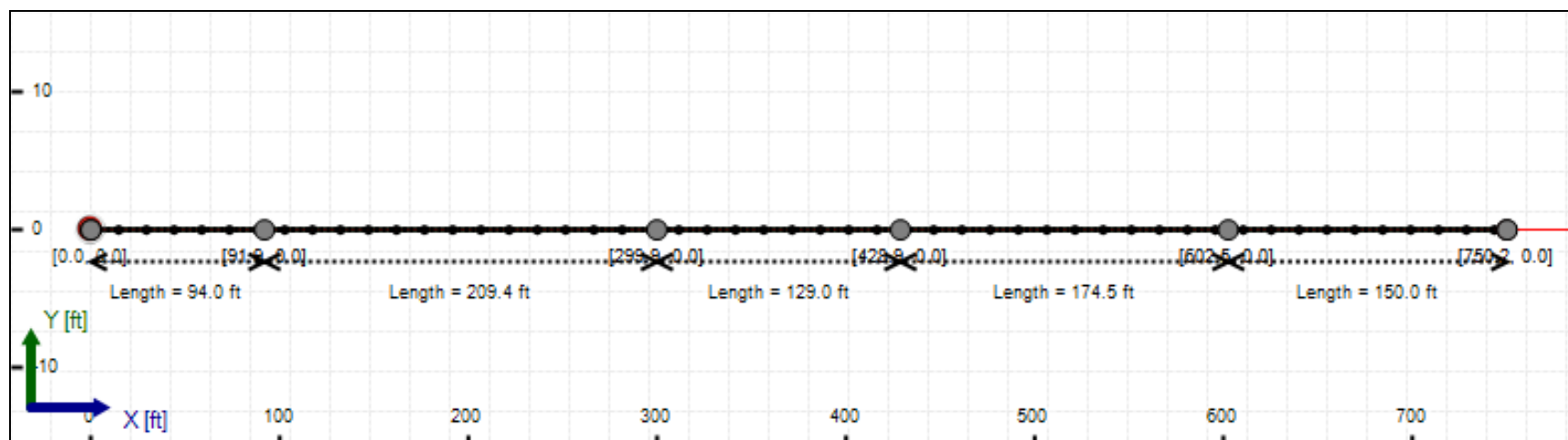
Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

## Bore Cross-Section View





## Bore Plan View



## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 10" (10.75")  
Pipe DR: 9  
Pipe Length: 765.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 1.34400002161662 ft  
Silo Width: 1.34400002161662 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	18.2	26.0
Water Pressure	13.7	13.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	31.9	39.7
<b>Deflection</b>		
Earth Load Deflection	4.951	7.078
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	5.083	7.210
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	143.5	178.6

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	13329.7	13329.7
Pullback Stress [psi]	371.7	371.7
Pullback Strain	6.465E-3	6.465E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	371.7	396.4
Tensile Strain	6.465E-3	7.343E-3

Net External Pressure = 23.0 [psi ]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb



### In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	5.083	7.5	1.5	OK
Unconstrained Collapse [psi]	31.9	87.7	2.8	OK
Compressive Wall Stress [psi]	143.5	1150.0	8.0	OK

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	37.7	233.8	6.2	OK
Tensile Stress [psi]	396.4	1200.0	3.0	OK

## Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.75 in	86.085 psi	80.089 psi
1	8.75 in	12.00 in	86.035 psi	80.006 psi
2	12.00 in	16.13 in	85.949 psi	79.864 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

## Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
Yes	600	37
Yes	300	32
No	200	29
No	100	25
No	6	17
No	3	15

Flow Rate (Q): 70.00 US (liquid) gallon/min

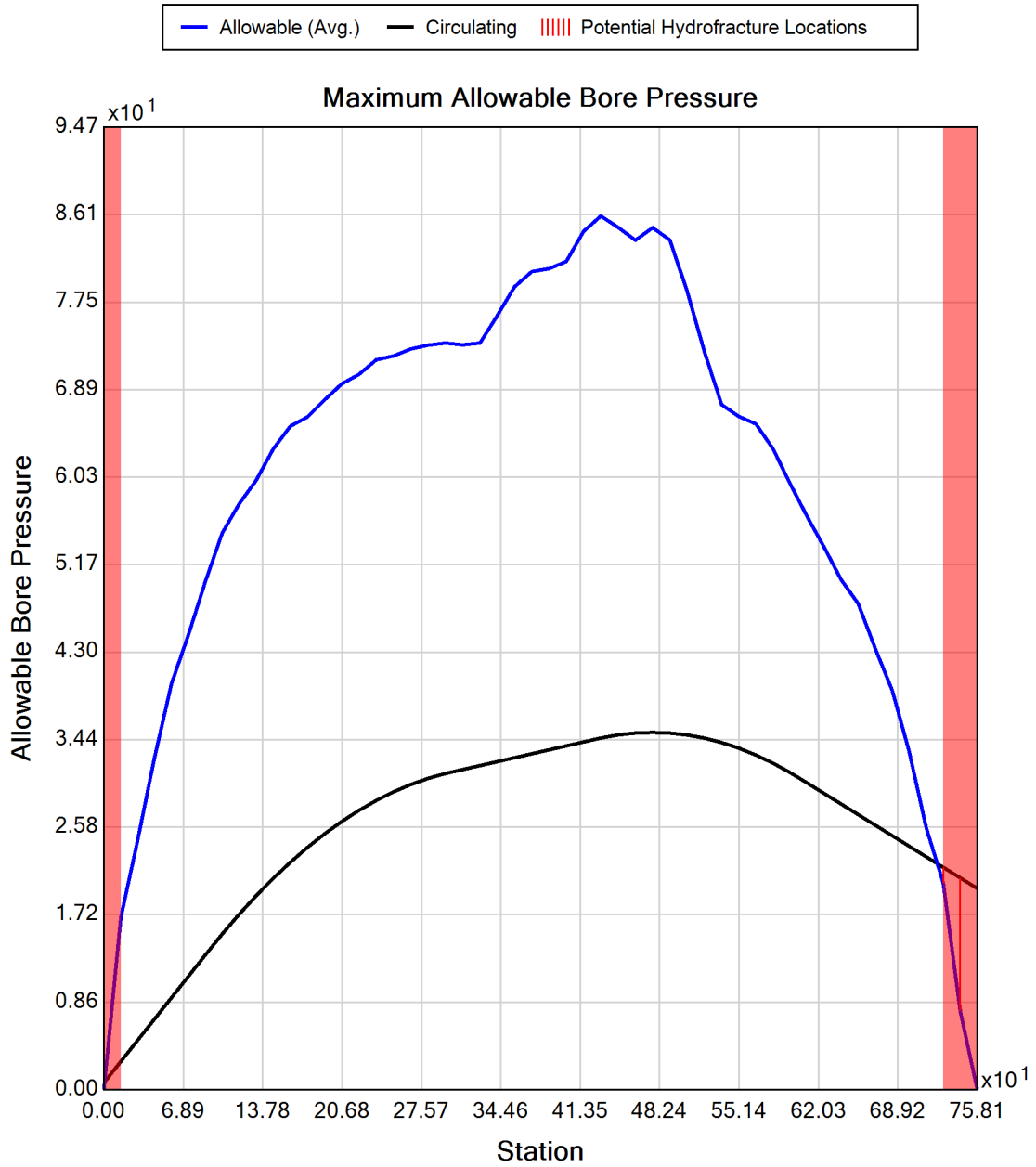
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 5.00

Yield Point (YP): 27.00

Effective Viscosity (cP): 1601.0







## Generated Output



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## Project Summary

General:

Kiewit - CHPE  
Ref: New York  
204-3701  
Start Date: 08-06-2024  
End Date: 09-10-2024

Designer:

Aaron Coady  
Tetra Tech Rooney  
115 Inverness Drive East, Suite 300  
Englewood, Colorado  
United States 80112  
aaron.coady@tetrattech.com

Description:

Segment 10 (Package 6)  
Conduit 2  
HDD 111.A.A  
DWG C-324.1A

## Input Summary

Start Coordinate	(0.00, 0.00, 126.50) ft
End Coordinate	(750.00, 0.00, 125.76) ft
Project Length	750.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft



## Soil Summary

Number of Layers: 4

Soil Layer #1 USCS, Sand (S), SM

Depth: 1.00 ft

Unit Weight: 15.6618 (dry), 17.7639 (sat) [lb/US (liquid) gallon]

Phi: 30.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #2 USCS, Silt (M), ML

Depth: 6.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 10.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #4 USCS, Clay (C), CL

Depth: 30.00 ft

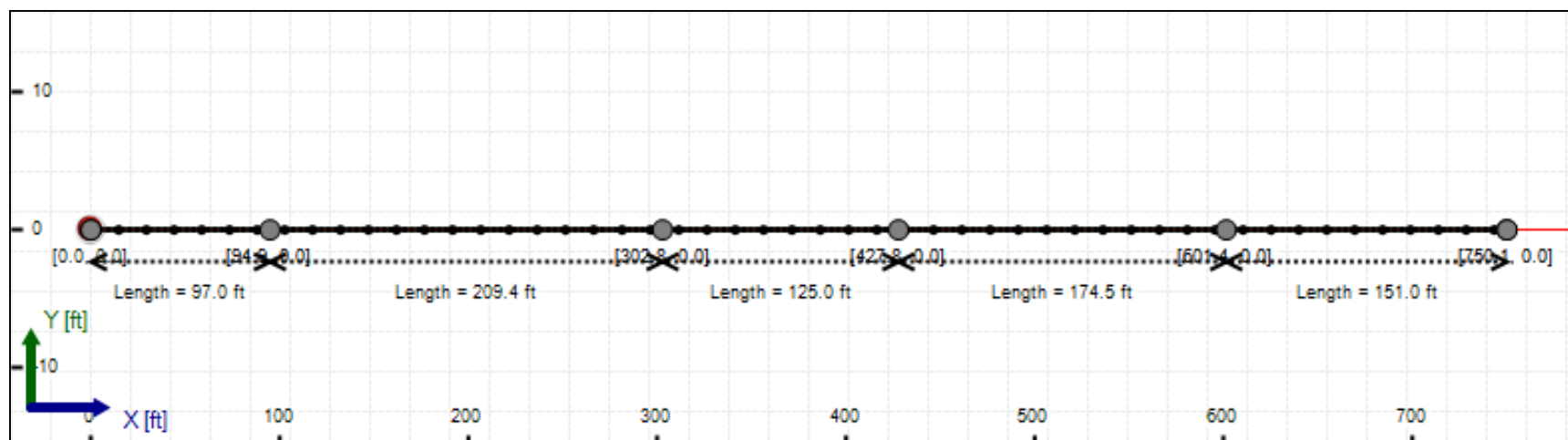
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

## Bore Cross-Section View



## Bore Plan View





## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 10" (10.75")  
Pipe DR: 9  
Pipe Length: 765.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 1.34400002161662 ft  
Silo Width: 1.34400002161662 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	20.1	25.8
Water Pressure	13.7	13.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	33.8	39.4
<b>Deflection</b>		
Earth Load Deflection	5.478	7.020
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	5.610	7.152
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	152.0	177.5

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	13322.8	13322.8
Pullback Stress [psi]	371.6	371.6
Pullback Strain	6.462E-3	6.462E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	371.6	396.5
Tensile Strain	6.462E-3	7.344E-3

Net External Pressure = 22.7 [psi ]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

### In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	5.610	7.5	1.3	OK
Unconstrained Collapse [psi]	33.8	83.7	2.5	OK
Compressive Wall Stress [psi]	152.0	1150.0	7.6	OK

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	37.8	233.8	6.2	OK
Tensile Stress [psi]	396.5	1200.0	3.0	OK



## Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.75 in	84.729 psi	79.835 psi
1	8.75 in	12.00 in	84.679 psi	79.751 psi
2	12.00 in	16.13 in	84.593 psi	79.608 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

## Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
Yes	600	37
Yes	300	32
No	200	29
No	100	25
No	6	17
No	3	15

Flow Rate (Q): 70.00 US (liquid) gallon/min

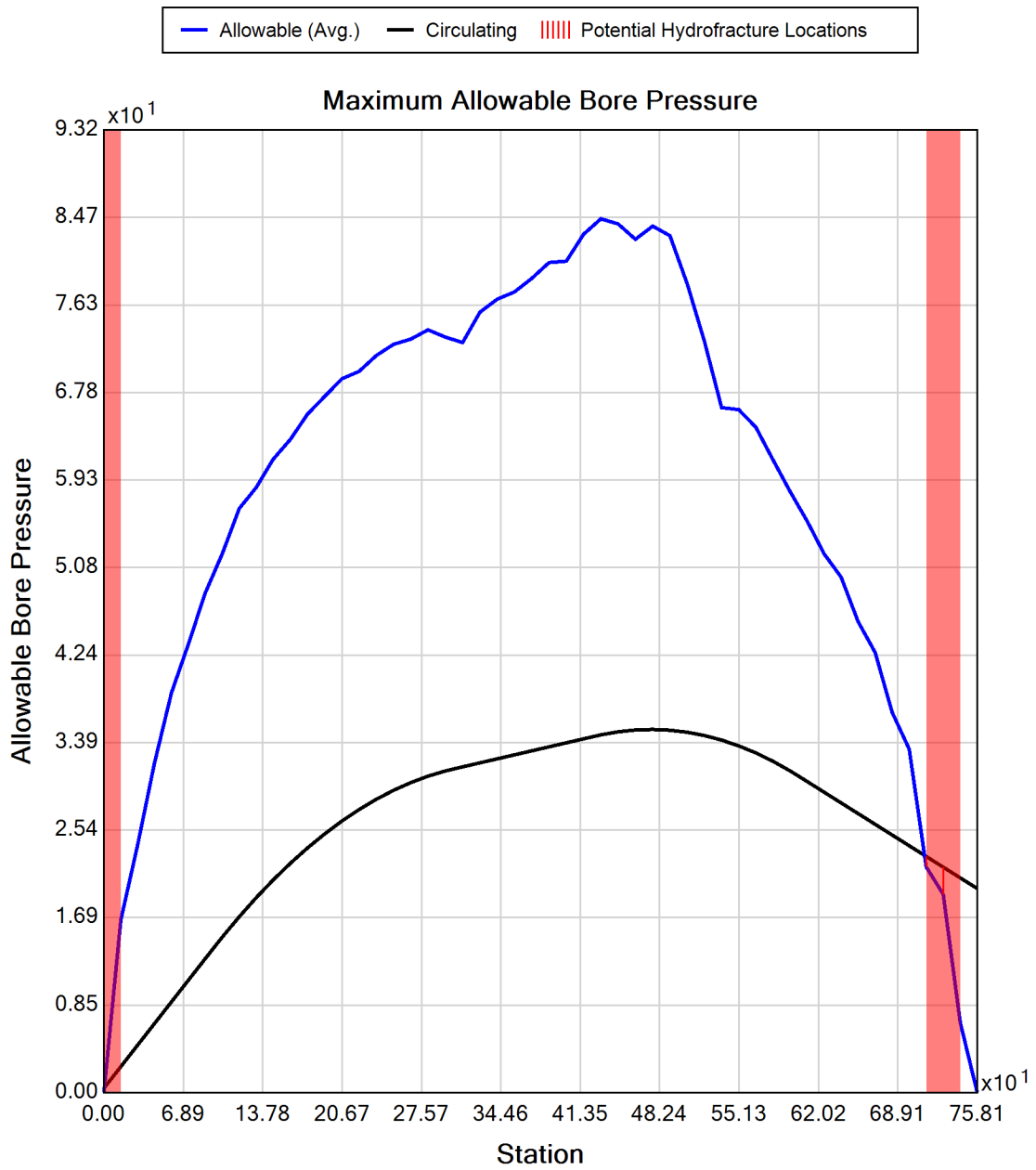
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 5.00

Yield Point (YP): 27.00

Effective Viscosity (cP): 1601.0





## Generated Output



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## Project Summary

General: Kiewit - CHPE  
Ref: New York  
204-3701  
Start Date: 05-24-2024  
End Date: 09-10-2024

Designer: Aaron Coady  
Tetra Tech Rooney  
115 Inverness Drive East, Suite 300  
Englewood, Colorado  
United States 80112  
aaron.coady@tetrattech.com

Description: Segment 10 (Package 6)  
Conduit 3  
HDD 111.A.A  
DWG C-324.1

## Input Summary

Start Coordinate	(0.00, 0.00, 125.79) ft
End Coordinate	(750.00, 0.00, 125.63) ft
Project Length	750.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	3.500 in
Pipe DR	9.0
Pipe Thickness	0.39 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

## Soil Summary

Number of Layers: 4

Soil Layer #1 USCS, Sand (S), SM

Depth: 1.00 ft

Unit Weight: 15.6618 (dry), 17.7639 (sat) [lb/US (liquid) gallon]

Phi: 30.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #2 USCS, Silt (M), ML

Depth: 6.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 10.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #4 USCS, Clay (C), CL

Depth: 30.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]



**Bore Entry: -12.0°**

**Bore Exit (target): 10.0°**

Length = 750.0 ft

Length = 94.0 ft

Radius = 1000.0 ft  
Arc Length = 209.4 ft

Max. Depth = 47.1 ft

Radius = 1000.0 ft  
Arc Length = 174.5 ft

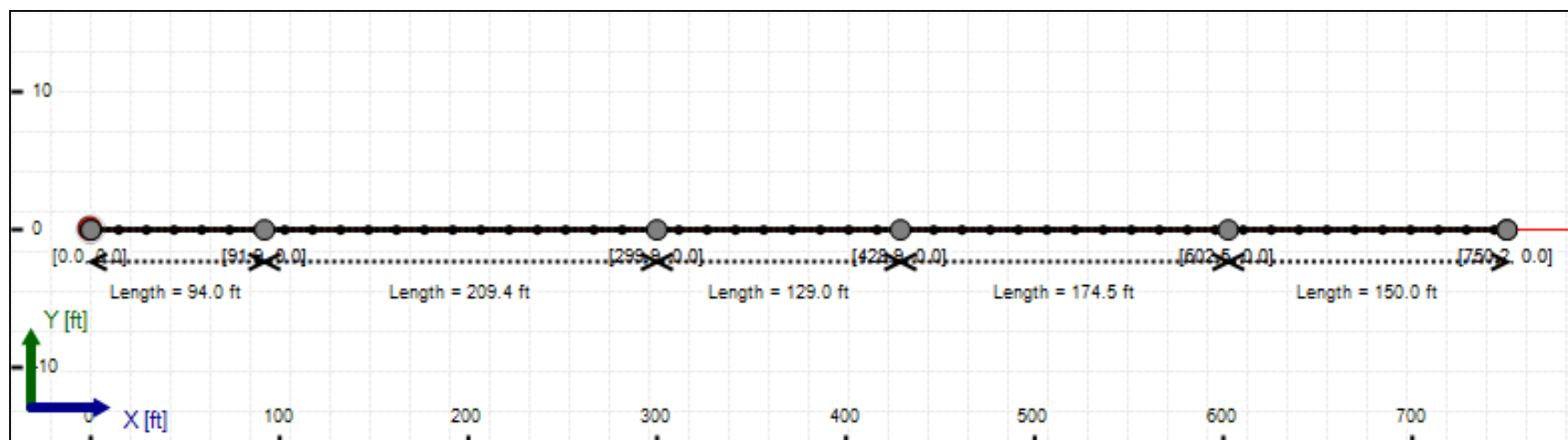
Length = 150.0 ft

Length = 129.0 ft

Coordinates: [125.8, 125.8], [91.9, 106.2], [299.9, 84.4], [428.9, 84.4], [602.5, 99.6], [750.2, 125.6]

Coordinate System: Z [ft] (vertical), X [ft] (horizontal)

## Bore Plan View



## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 3" (3.5")  
Pipe DR: 9  
Pipe Length: 765.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 0.625 ft  
Silo Width: 0.625 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon



### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	15.4	26.0
Water Pressure	13.7	13.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	29.1	39.7
<b>Deflection</b>		
Earth Load Deflection	4.183	7.078
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	4.226	7.121
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	130.8	178.6

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1525.6	1525.6
Pullback Stress [psi]	401.4	401.4
Pullback Strain	6.980E-3	6.980E-3
Bending Stress [psi]	0.0	8.4
Bending Strain	0	1.458E-4
Tensile Stress [psi]	401.4	408.7
Tensile Strain	6.980E-3	7.254E-3

Net External Pressure = 23.0 [psi ]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

### In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	4.226	7.5	1.8	OK
Unconstrained Collapse [psi]	29.1	94.7	3.3	OK
Compressive Wall Stress [psi]	130.8	1150.0	8.8	OK

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	37.7	233.9	6.2	OK
Tensile Stress [psi]	408.7	1200.0	2.9	OK

## Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.75 in	86.085 psi	80.089 psi
1	8.75 in	12.00 in	86.035 psi	80.006 psi
2	12.00 in	16.13 in	85.949 psi	79.864 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

## Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
Yes	600	37
Yes	300	32
No	200	29
No	100	25
No	6	17
No	3	15

Flow Rate (Q): 70.00 US (liquid) gallon/min

Drill Fluid Density: 10.500 lb/US (liquid) gallon

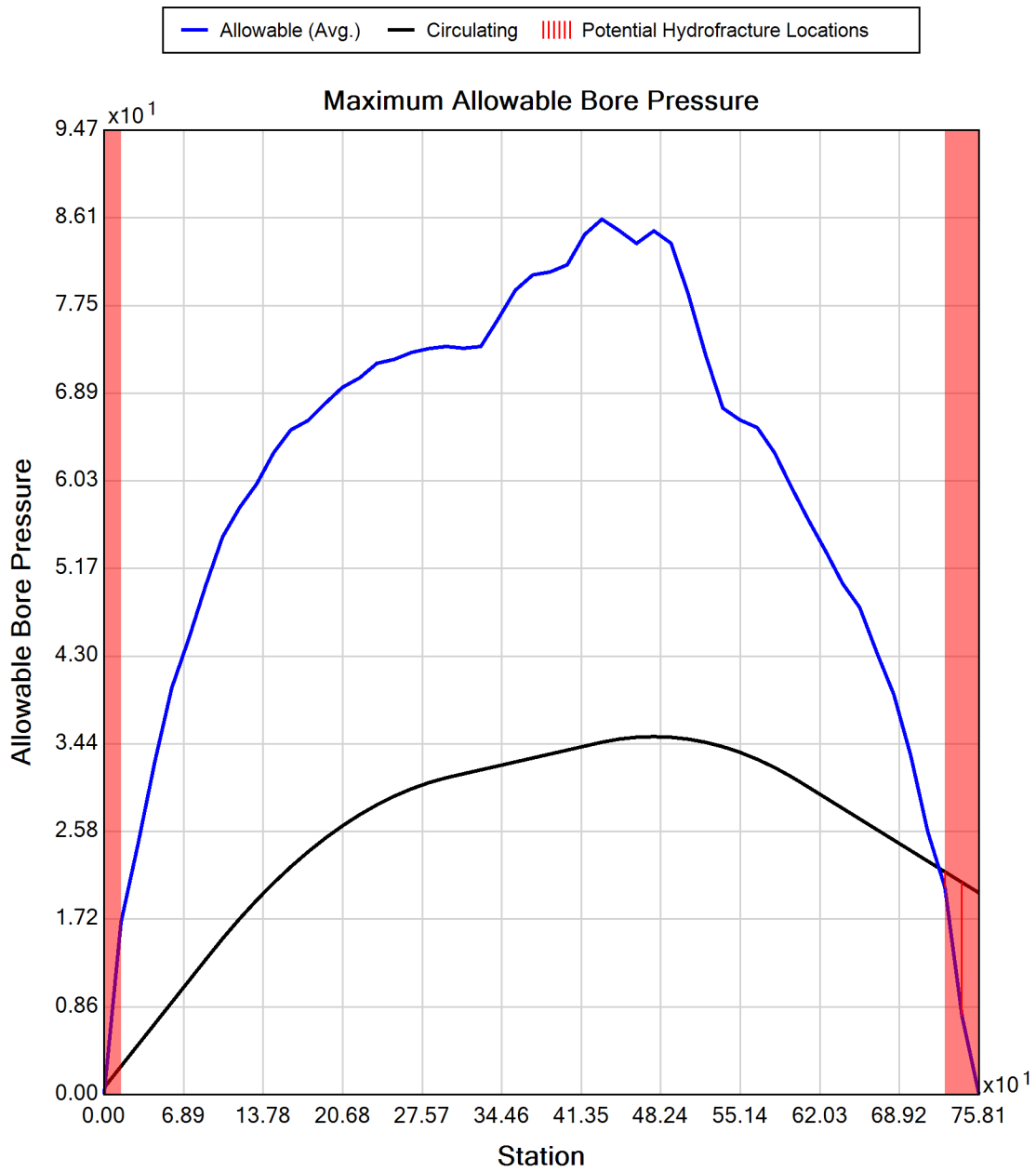
Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 5.00

Yield Point (YP): 27.00

Effective Viscosity (cP): 1601.0







## Generated Output



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## Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 05-24-2024 End Date: 09-10-2024
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 10 (Package 6) Conduit 1 & 3 Equivalent Pipe Bundle HDD 111.A.A DWG C-324.1

## Input Summary

Start Coordinate	(0.00, 0.00, 125.79) ft
End Coordinate	(750.00, 0.00, 125.63) ft
Project Length	750.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	11.305 in
Pipe DR	8.5
Pipe Thickness	1.33 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft



## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 11.305 in  
Pipe DR: 8.5  
Pipe Length: 765.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 1.4129999478658 ft  
Silo Width: 1.4129999478658 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	18.3	26.0
Water Pressure	13.7	13.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	32.0	39.7
<b>Deflection</b>		
Earth Load Deflection	4.110	5.832
Buoyant Deflection	0.117	0.117
Reissner Effect	0	0
Net Deflection	4.227	5.949
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	136.1	168.7

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	14589.1	14589.1
Pullback Stress [psi]	350.0	350.0
Pullback Strain	6.088E-3	6.088E-3
Bending Stress [psi]	0.0	27.1
Bending Strain	0	4.710E-4
Tensile Stress [psi]	350.0	376.3
Tensile Strain	6.088E-3	7.016E-3

Net External Pressure = 23.0 [psi ]

Buoyant Deflection = 0.1

Hydrokinetic Force = 627.2 lb

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.057	7.5	130.7	OK
Unconstrained Collapse [psi]	37.7	285.1	7.6	OK
Tensile Stress [psi]	376.3	1200.0	3.2	OK



## Generated Output



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## Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 05-24-2024 End Date: 09-10-2024
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 10 (Package 6) Conduit 1 HDD 111.A.B DWG C-324.2

## Input Summary

Start Coordinate	(0.00, 0.00, 121.71) ft
End Coordinate	(925.00, 0.00, 117.77) ft
Project Length	925.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

## Soil Summary

Number of Layers: 4

Soil Layer #1 USCS, Clay (C), CH

Depth: 20.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #2 USCS, Clay (C), CL

Depth: 15.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 7.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

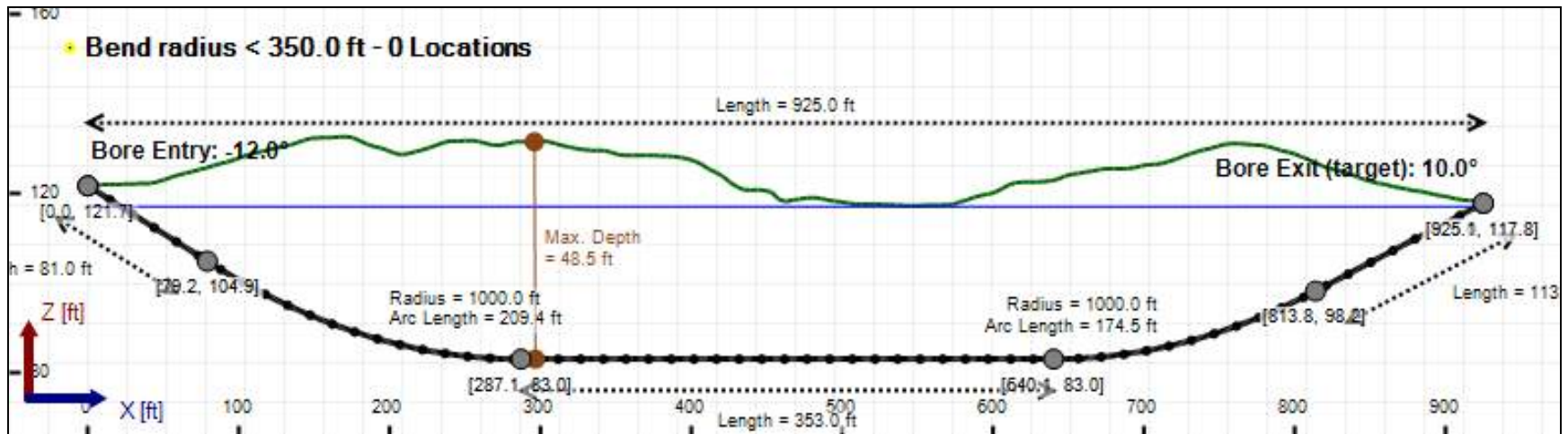
Soil Layer #4 USCS, Silt (M), ML

Depth: 10.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

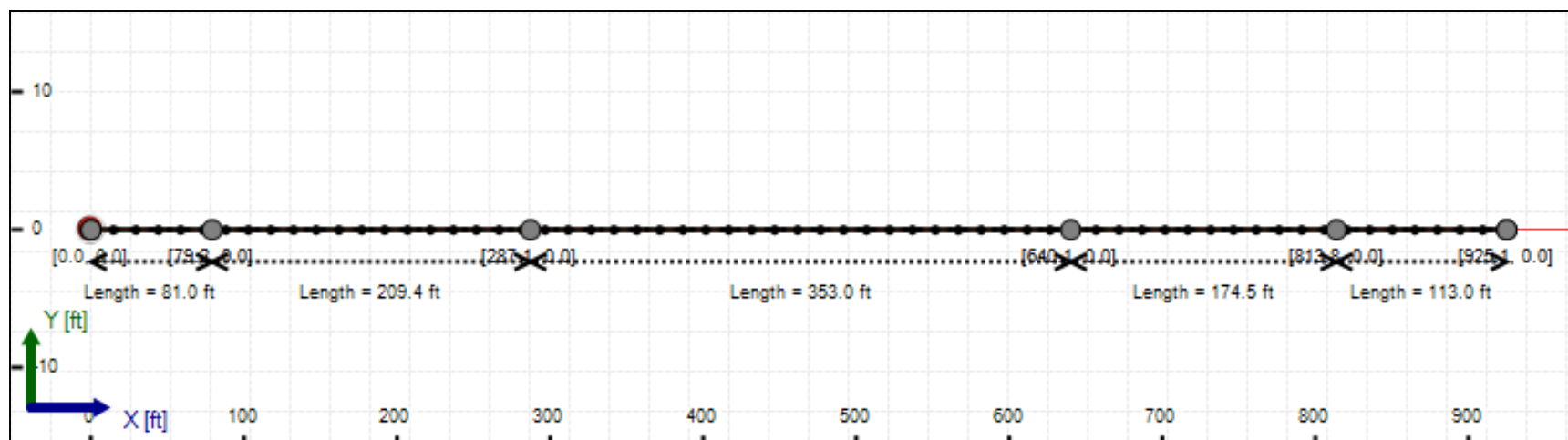
Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

## Bore Cross-Section View





## Bore Plan View



## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 10" (10.75")  
Pipe DR: 9  
Pipe Length: 945.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 1.34400002161662 ft  
Silo Width: 1.34400002161662 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	22.9	22.9
Water Pressure	14.7	14.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	37.6	37.6
<b>Deflection</b>		
Earth Load Deflection	6.238	6.238
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	6.370	6.370
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	169.4	169.4

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	15874.0	15874.0
Pullback Stress [psi]	442.7	442.7
Pullback Strain	7.699E-3	7.699E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	442.7	467.0
Tensile Strain	7.699E-3	8.569E-3

Net External Pressure = 20.1 [psi ]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

### In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	6.370	7.5	1.2	OK
Unconstrained Collapse [psi]	37.6	78.3	2.1	OK
Compressive Wall Stress [psi]	169.4	1150.0	6.8	OK

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	35.2	229.6	6.5	OK
Tensile Stress [psi]	467.0	1200.0	2.6	OK



## Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.75 in	70.538 psi	78.037 psi
1	8.75 in	12.00 in	70.472 psi	77.959 psi
2	12.00 in	16.13 in	70.360 psi	77.826 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

## Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
Yes	600	37
Yes	300	32
No	200	29
No	100	25
No	6	17
No	3	15

Flow Rate (Q): 70.00 US (liquid) gallon/min

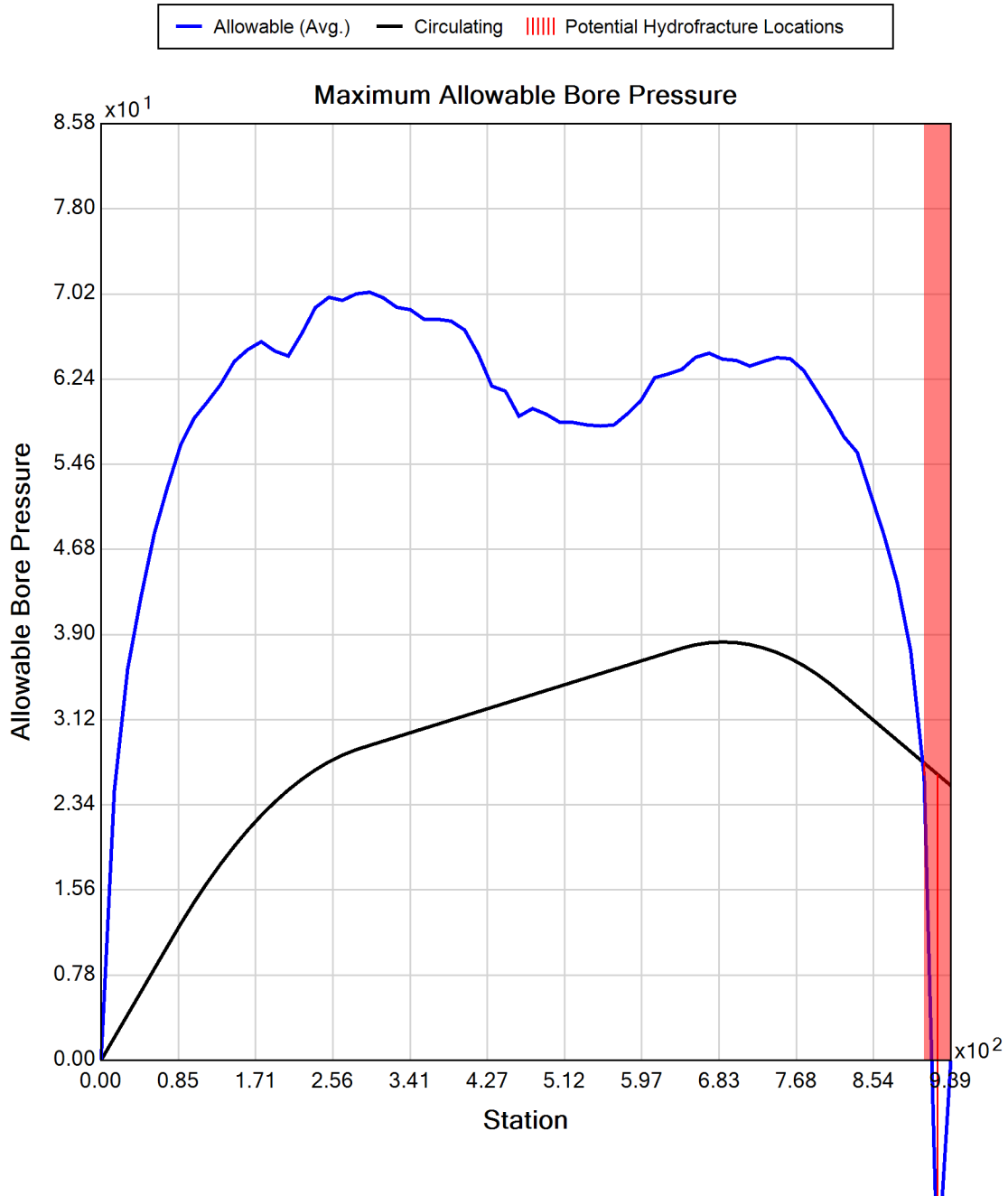
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 5.00

Yield Point (YP): 27.00

Effective Viscosity (cP): 1601.0





## Generated Output



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Before you start any digging project, do not forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call Systems International, contact the appropriate utility companies or national regulating authority to locate and mark the underground installations. If you do not call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or experience job delays.

OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

## Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 05-24-2024 End Date: 09-10-2024
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 10 (Package 6) Conduit 2 HDD 111.A.B DWG C-324.2A



## Input Summary

Start Coordinate	(0.00, 0.00, 122.67) ft
End Coordinate	(935.00, 0.00, 118.77) ft
Project Length	935.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

## Soil Summary

Number of Layers: 4

Soil Layer #1 USCS, Clay (C), CH

Depth: 20.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #2 USCS, Clay (C), CL

Depth: 15.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 7.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

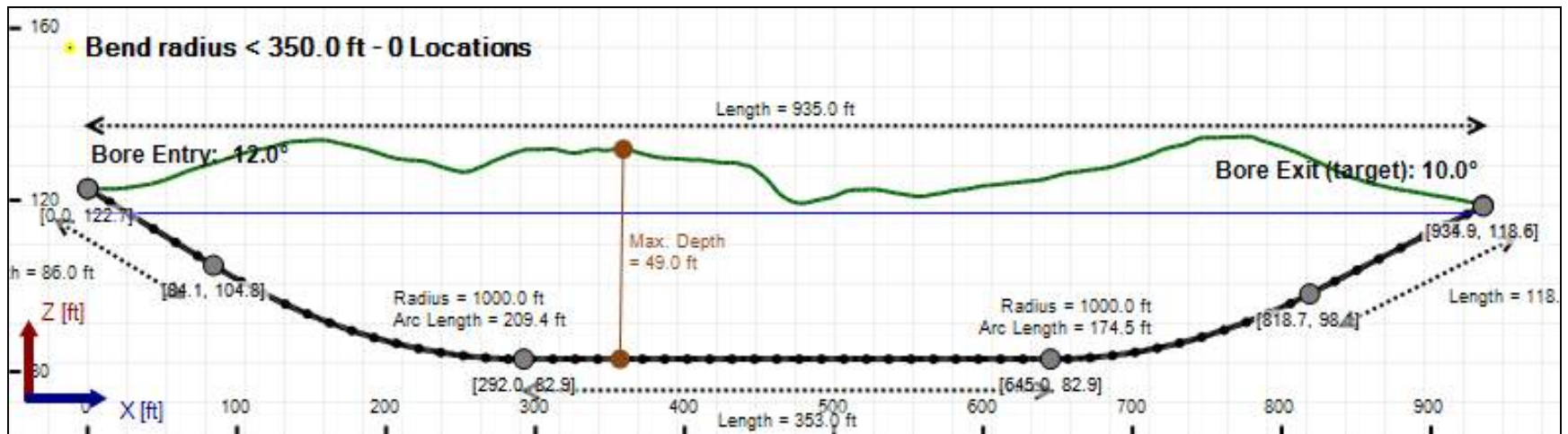
Soil Layer #4 USCS, Silt (M), ML

Depth: 10.00 ft

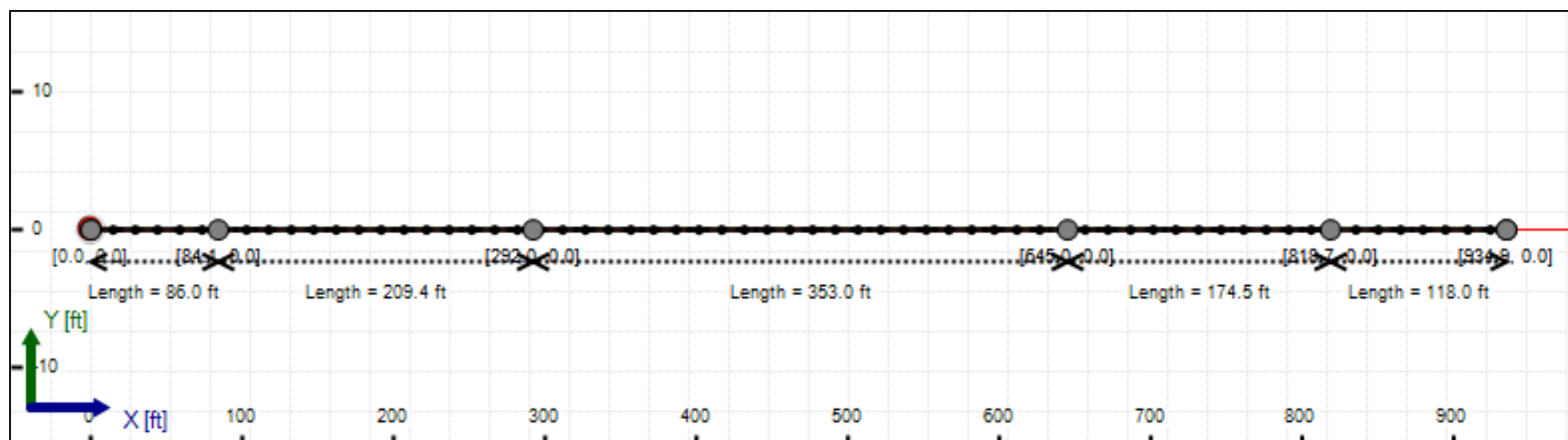
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

## Bore Cross-Section View



## Bore Plan View





## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 10" (10.75")  
Pipe DR: 9  
Pipe Length: 945.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 1.34400002161662 ft  
Silo Width: 1.34400002161662 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	23.3	23.3
Water Pressure	14.8	14.8
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	38.0	38.0
<b>Deflection</b>		
Earth Load Deflection	6.336	6.336
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	6.468	6.468
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	171.1	171.1

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	15787.6	15787.6
Pullback Stress [psi]	440.3	440.3
Pullback Strain	7.657E-3	7.657E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	440.3	465.4
Tensile Strain	7.657E-3	8.541E-3

Net External Pressure = 20.1 [psi ]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

### In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	6.468	7.5	1.2	OK
Unconstrained Collapse [psi]	38.0	77.6	2.0	OK
Compressive Wall Stress [psi]	171.1	1150.0	6.7	OK

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	35.8	229.7	6.4	OK
Tensile Stress [psi]	465.4	1200.0	2.6	OK

## Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.75 in	71.008 psi	78.434 psi
1	8.75 in	12.00 in	70.943 psi	78.357 psi
2	12.00 in	16.13 in	70.832 psi	78.227 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

## Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
Yes	600	37
Yes	300	32
No	200	29
No	100	25
No	6	17
No	3	15

Flow Rate (Q): 70.00 US (liquid) gallon/min

Drill Fluid Density: 10.500 lb/US (liquid) gallon

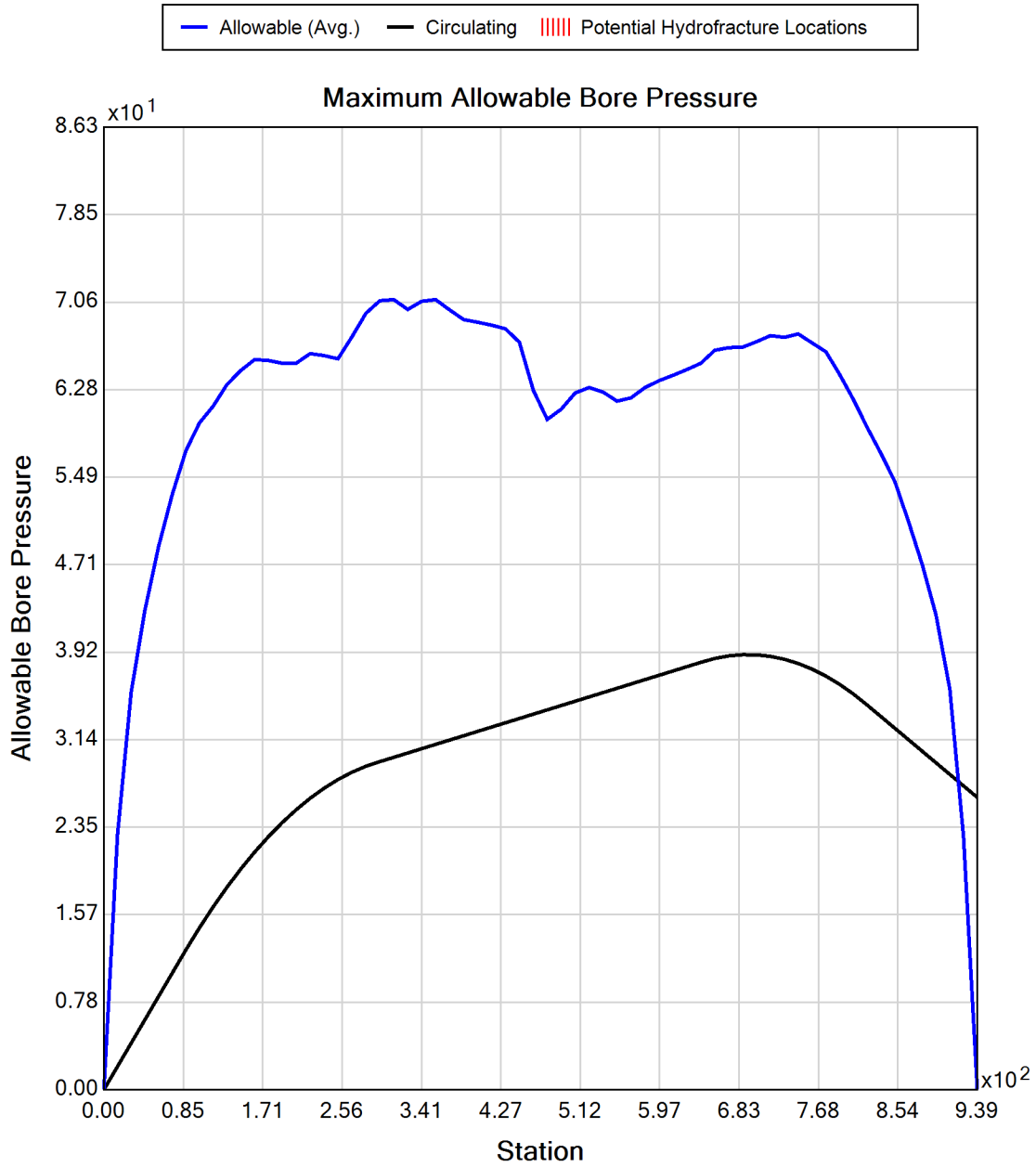
Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 5.00

Yield Point (YP): 27.00

Effective Viscosity (cP): 1601.0







## Generated Output



**WARNING:** The accuracy of the data obtained by the BoreAid® system is highly dependent upon accurate data gathering, data input and proper use of the software. Vermeer is not responsible for that information. BoreAid® data is not intended to replace the need for future on-site utility locating, measuring and verification procedures, which are essential for accurate placement of new underground installations and avoidance of existing utilities.

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OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

## Project Summary

General:

Kiewit - CHPE  
Ref: New York  
204-3701  
Start Date: 05-24-2024  
End Date: 09-10-2024

Designer:

Aaron Coady  
Tetra Tech Rooney  
115 Inverness Drive East, Suite 300  
Englewood, Colorado  
United States 80112  
aaron.coady@tetrattech.com

Description:

Segment 10 (Package 6)  
Conduit 3  
HDD 111.A.B  
DWG C-324.2

## Input Summary

Start Coordinate	(0.00, 0.00, 121.71) ft
End Coordinate	(925.00, 0.00, 117.77) ft
Project Length	925.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	3.500 in
Pipe DR	9.0
Pipe Thickness	0.39 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft



## Soil Summary

Number of Layers: 4

Soil Layer #1 USCS, Clay (C), CH

Depth: 20.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #2 USCS, Clay (C), CL

Depth: 15.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 7.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

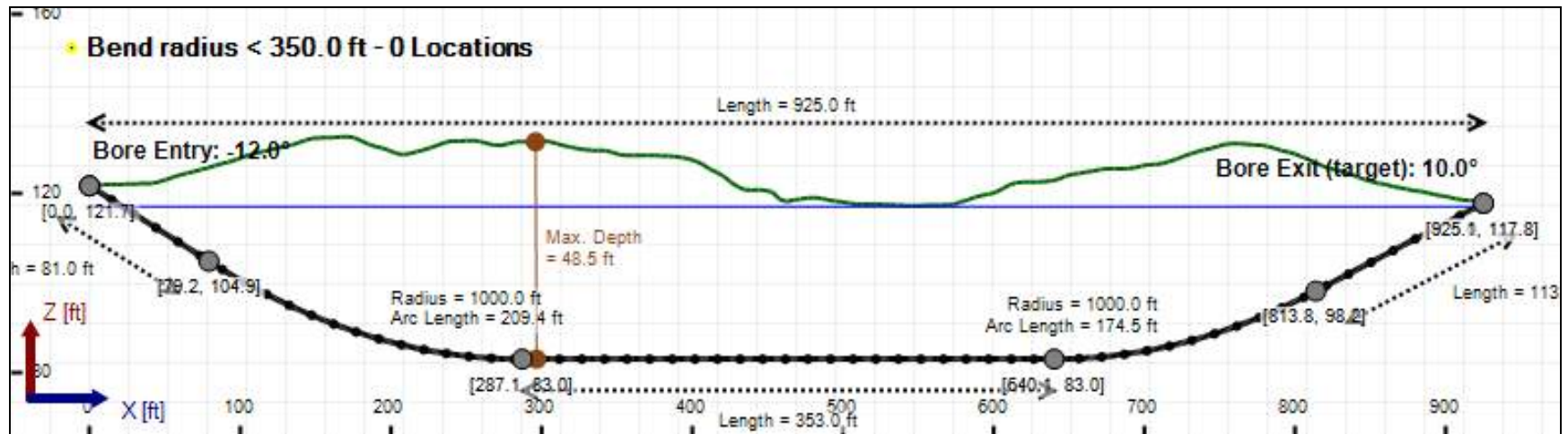
Soil Layer #4 USCS, Silt (M), ML

Depth: 10.00 ft

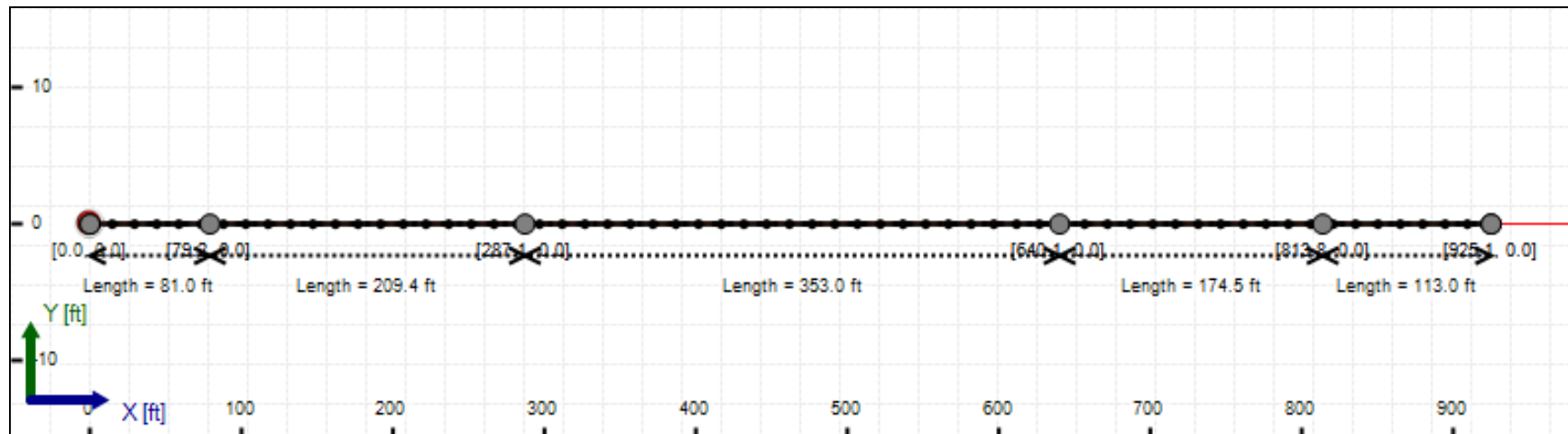
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

## Bore Cross-Section View



## Bore Plan View



## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 3" (3.5")  
Pipe DR: 9  
Pipe Length: 945.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 0.625 ft  
Silo Width: 0.625 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon



### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	22.9	22.9
Water Pressure	14.7	14.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	37.6	37.6
<b>Deflection</b>		
Earth Load Deflection	6.238	6.238
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	6.281	6.281
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	169.4	169.4

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1795.3	1795.3
Pullback Stress [psi]	472.3	472.3
Pullback Strain	8.214E-3	8.214E-3
Bending Stress [psi]	0.0	8.4
Bending Strain	0	1.458E-4
Tensile Stress [psi]	472.3	479.2
Tensile Strain	8.214E-3	8.480E-3

Net External Pressure = 20.1 [psi ]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

### In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	6.281	7.5	1.2	OK
Unconstrained Collapse [psi]	37.6	78.9	2.1	OK
Compressive Wall Stress [psi]	169.4	1150.0	6.8	OK

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	35.2	229.7	6.5	OK
Tensile Stress [psi]	479.2	1200.0	2.5	OK

## Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.75 in	70.538 psi	78.037 psi
1	8.75 in	12.00 in	70.472 psi	77.959 psi
2	12.00 in	16.13 in	70.360 psi	77.826 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

## Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
Yes	600	37
Yes	300	32
No	200	29
No	100	25
No	6	17
No	3	15

Flow Rate (Q): 70.00 US (liquid) gallon/min

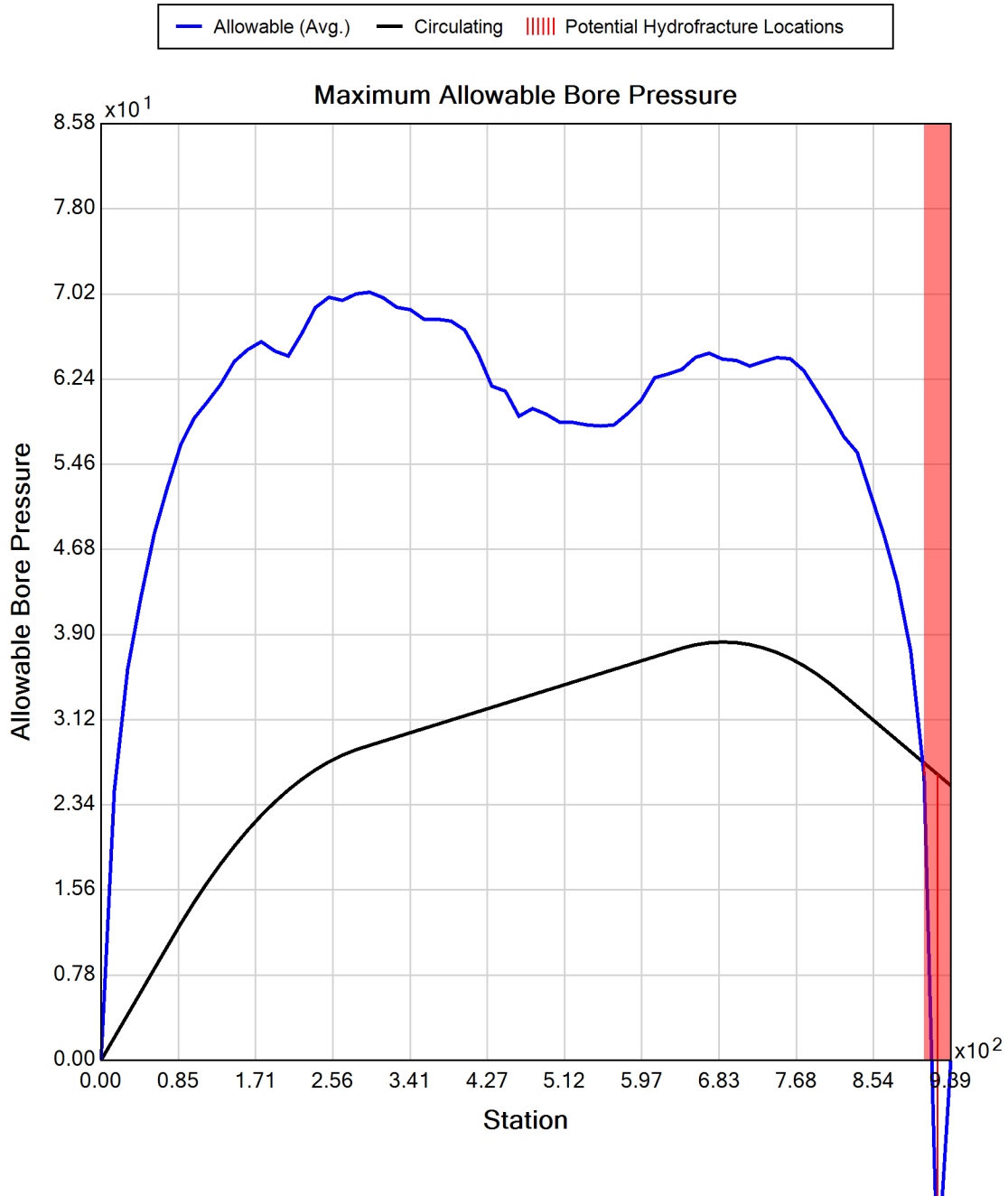
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 5.00

Yield Point (YP): 27.00

Effective Viscosity (cP): 1601.0





## Generated Output



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## Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 05-24-2024 End Date: 09-10-2024
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 10 (Package 6) Conduit 1 & 3 Equivalent Pipe Bundle HDD 111.A.B DWG C-324.2

## Input Summary

Start Coordinate	(0.00, 0.00, 121.71) ft
End Coordinate	(925.00, 0.00, 117.77) ft
Project Length	925.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	11.305 in
Pipe DR	8.5
Pipe Thickness	1.33 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 11.305 in  
Pipe DR: 8.5  
Pipe Length: 945.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 1.4129999478658 ft  
Silo Width: 1.4129999478658 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	22.9	22.9
Water Pressure	14.7	14.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	37.6	37.6
<b>Deflection</b>		
Earth Load Deflection	5.140	5.140
Buoyant Deflection	0.117	0.117
Reissner Effect	0	0
Net Deflection	5.257	5.257
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	160.0	160.0

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	17352.7	17352.7
Pullback Stress [psi]	416.3	416.3
Pullback Strain	7.241E-3	7.241E-3
Bending Stress [psi]	0.0	27.1
Bending Strain	0	4.710E-4
Tensile Stress [psi]	416.3	442.3
Tensile Strain	7.241E-3	8.163E-3

Net External Pressure = 20.1 [psi ]

Buoyant Deflection = 0.1

Hydrokinetic Force = 627.2 lb

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.057	7.5	130.7	OK
Unconstrained Collapse [psi]	35.2	280.4	8.0	OK
Tensile Stress [psi]	442.3	1200.0	2.7	OK

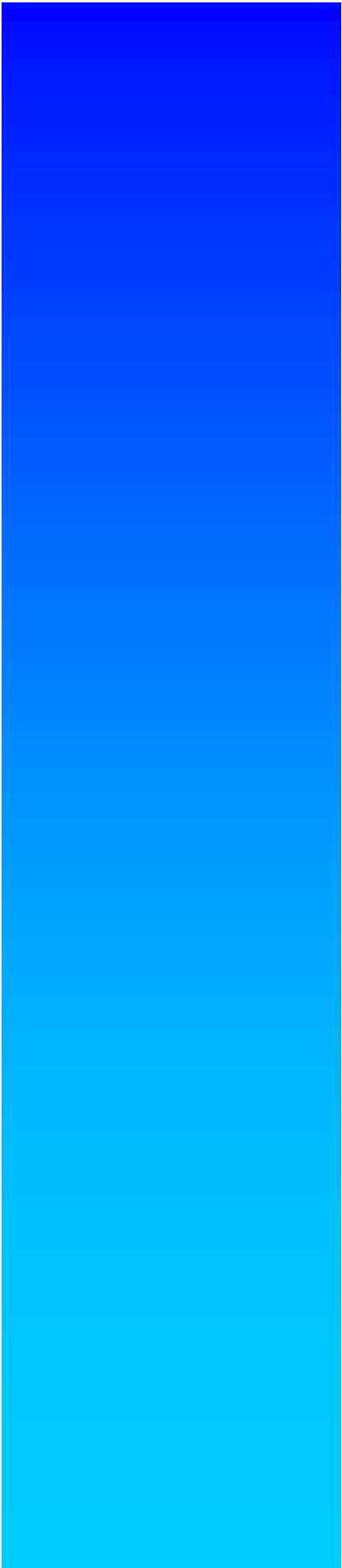


## **Appendix D**

### **Sheets Added**

## Appendix D

### HDD Design Drawings



# Champlain Hudson Power Express



## ***UPDATES TO*** **Inadvertent Release Contingency** **Plan for Horizontal Directional Drilling** **in Segment 10 - Package 6** ***FOR HDD 111.A.A & 111.A.B***

*For Design Rev. #0 || Design Rev. Date: 10/22/2024*

**Selkirk to Catskill**  
**Greene & Albany County, New York**

---

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*TTR Project Number 204-3701*

***Prepared for:***  
***Transmission Developers Inc.***  
*600 Broadway Street*  
*Albany, NY 12207*

***Prepared by:***  
***Tetra Tech Engineering and Surveying, P.C.***  
***(A New York Professional Corporation)***  
*115 Inverness Drive East, Suite 300*  
*Englewood, CO 80112*  
*(303) 792-5911*



***October 2024***

## **9.0 CROSSING SPECIFIC CONDITIONS AND IR ANALYSIS**

### **9.26 HDD CROSSING #111.A.A**

#### **Text Revised**

##### Surface conditions at HDD #111.A.A:

*HDD #111.A.A consists of two straight (in plan view) HDD drills, each drill is approximately 750 feet long. Each drill will contain a 10" HDPE casing and one of the drills will be bundled with a 3" HDPE casing. The HDD drills will pass approximately 47 feet below the CSX railroad tracks. The approximate center of the HDD under the railroad track is at latitude 42.269471N and longitude 73.848458W (Approx. STA. 64017+75) in Greene County, NY. The HDD entry (north side) is in a wetland to the east of the railroad tracks; the HDD exit (south side) is in a wetland to the west of the railroad tracks. The surface terrain in this area is generally flat throughout the path of the HDD with the entry at El. 126 feet and exit at El. 126 feet (reference datum NAVD 1988).*

*The drills have no designed horizontal curve (in the plan view). The vertical curves of the drill path are designed so that the drill will pass beneath the railroad. The proposed work at this location must be constructed in accordance with the Article VII Certificate and associated EM&CP.*

##### Ground conditions at HDD #111.A.A:

*At this time, no geotechnical borings are available for HDD #111.A.A. There are two planned Geotechnical borings that will be completed prior to construction once landowner access permissions have been granted. For the purposes of the BoreAid analyses Geotechnical Boring KB-219.3 was used as it was most similar to the closest Geotechnical boring (B219.5-1) to HDD #111.A.A and it covered the full depth of the HDD profile. Boring KB-219.3 is located approximately 1,150 feet north of HDD #111.A.A. KB-219.3 was performed by Kiewit on 4/20/2023 and terminated 52 feet deep. For the first 42 feet of the boring, the soil was primarily composed of fat and lean Clay before transitioning into Silt which composed the remainder of the bore path. The Geotechnical report for this HDD and test data is provided in Appendix B of the Design Summary Report (DSR) for segment 10 package 6.*

*Based on the borings, the soil profile for the HDD #111.A.A BoreAid analyses will be divided into four [4] layers: Fat Clay (CH), Lean Clay (CL), Lean Clay (CL), and Silt (ML). The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix A.*

Specific design considerations for HDD #111.A.A include:

*Preliminary analysis of the geotechnical bores, assuming typical drilling methods, indicates that the maximum allowable pressure capacity in the middle of the alignment is approximately 86 psi and the drill fluid pressure estimated to occur in the middle portion ranges from 30 to 35 psi. In the remaining section of the drill the maximum allowable pressure ranges from approximately 86 to 14 psi. The approximate minimum required drill fluid pressure needed to return cuttings ranges from 3 to 35 psi and the estimated operating drill fluid pressure can range from 4 to 44 psi. A sketch showing the maximum allowable pressure and the minimum required drill fluid pressure is provided in the BoreAid analyses in Appendix A.*

*It appears that there is a potential for inadvertent release at the entry and exit of the HDD (as is common). These could be controlled through the use of conductor casings, haybales, silt fences, erosion control measures and vacuum trucks.*

*In our opinion the conditions conducive to inadvertent releases that may exist at this site based on the ground conditions described in the boring include:*

- Highly permeable soil such as cobbles and gravel in the surficial fill.*
- Areas of reduced soil cover located along the alignment*

*Additional design considerations and recommended IR preventative measures include:*

- Drilling an 8in or larger diameter pilot hole is recommended to reduce the required drill fluid pressures*
- Requiring monitoring and controlling drilling fluid pressures with downhole sensors during pilot hole and reaming operations.*
- Requiring drilling fluid composition and drilling procedures that minimize drilling fluid pressures.*
- Requiring drilling fluids that adequately address site-specific drilling concerns while posing the least threat to the environment.*
- Increased monitoring and potential for reduced drill fluid pressures as the drill path approaches the Geotech bore locations. If a reduction in drill fluid pressures is noticed at a specific Geotech location that location can be proactively used as a strategic drill fluid containment relief well.*



- *If pressure is reaching the maximum allowable, the contractor can trip back as needed to clean the hole, before advancing the HDD.*
- *The contractor may elect to minimize drill fluid pressures as they approach the exit and/or push the drill bit over the final 60-feet.*

*When the additional Geotechnical boring logs are completed, the Annular Pressure calculations and IR Risk assessment will be reviewed and updated as needed.*

## **9.27 HDD CROSSING #111.A.B**

### **Text Revised**

Surface conditions at HDD #111.A.B:

*HDD #111.A.B consists of two straight (in plan view) HDD drills, each drill is approximately 930 feet long. Each drill will contain a 10" HDPE casing and one of the drills will be bundled with a 3" HDPE casing. The HDD drills will pass approximately 49 feet below the CSX railroad tracks. The approximate center of the HDD under the railroad track is at latitude 42.247746N and longitude 73.857836W (Approx. STA. 64101+60) in Greene County, NY. The HDD entry (north side) is in a wetland to the west of the railroad tracks; the HDD exit (south side) is in a forested area to the east of the railroad tracks. The surface terrain in this area varies throughout the path of the HDD with the entry at El. 122 feet and exit at El. 118 feet (reference datum NAVD 1988).*

*The drills have no designed horizontal curve (in the plan view). The vertical curves of the drill path are designed so that the drill will pass beneath the railroad. The proposed work at this location must be constructed in accordance with the Article VII Certificate and associated EM&CP.*

Ground conditions at HDD #111.A.B:

*At this time, no geotechnical borings are available for HDD #111.A.B. There are two planned Geotechnical borings that will be completed prior to construction once landowner access permissions have been granted. For the purposes of the BoreAid analyses Geotechnical Boring SC-4 was used because it was the closest Geotechnical boring to HDD #111.A.B. Boring SC-4 is located approximately 365 feet south of HDD #111.A.B. SC-4 was performed by AECOM on 1/28/2021 and terminated 16 feet deep. For the first 5 feet of the boring, the soil was primarily composed of Sand and Silt before transitioning into Clay which composed*

*the remainder of the bore path. The Geotechnical report for this HDD and test data is provided in Appendix B of the Design Summary Report (DSR) for segment 10 package 6.*

*Based on the borings, the soil profile for the HDD #111.A.B BoreAid analyses will be divided into four [4] layers: Silty Sand (SM), Silt (ML), Clay (CL), and Clay (CL). The chosen test bore did not reach the full depth of the drill profile, so for the purposes of the BoreAid analysis the final clay layer was assumed to extend the full depth of the drill profile. The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix A.*

Specific design considerations for HDD #111.A.B include:

*Preliminary analysis of the geotechnical bores, assuming typical drilling methods, indicates that the maximum allowable pressure capacity in the middle of the alignment is approximately 71 psi and the drill fluid pressure estimated to occur in the middle portion ranges from 25 to 35 psi. In the remaining section of the drill the maximum allowable pressure ranges from approximately 71 to 31 psi. The approximate minimum required drill fluid pressure needed to return cuttings ranges from 2 to 39 psi and the estimated operating drill fluid pressure can range from 3 to 49 psi. A sketch showing the maximum allowable pressure and the minimum required drill fluid pressure is provided in the BoreAid analyses in Appendix A.*

*It appears that there is a potential for inadvertent release at the exit of the HDD (as is common). This could be controlled through the use of conductor casings, haybales, silt fences, erosion control measures and vacuum trucks.*

*In our opinion the conditions conducive to inadvertent releases that may exist at this site based on the ground conditions described in the boring include:*

- Highly permeable soil such as cobbles and gravel in the surficial fill.*
- Areas of reduced soil cover located along the alignment*

*Additional design considerations and recommended IR preventative measures include:*

- Drilling an 8in or larger diameter pilot hole is recommended to reduce the required drill fluid pressures*
- Requiring monitoring and controlling drilling fluid pressures with downhole sensors during pilot hole and reaming operations.*
- Requiring drilling fluid composition and drilling procedures that minimize drilling fluid pressures.*
- Requiring drilling fluids that adequately address site-specific drilling concerns while posing the least threat to the environment.*

- *Increased monitoring and potential for reduced drill fluid pressures as the drill path approaches the Geotech bore locations. If a reduction in drill fluid pressures is noticed at a specific Geotech location that location can be proactively used as a strategic drill fluid containment relief well.*
- *If pressure is reaching the maximum allowable, the contractor can trip back as needed to clean the hole, before advancing the HDD.*
- *The contractor may elect to minimize drill fluid pressures as they approach the exit and/or push the drill bit over the final 30-feet.*

*When the additional Geotechnical boring logs are completed, the Annular Pressure calculations and IR Risk assessment will be reviewed and updated as needed.*

## **Appendix A**

### **BoreAid Calculations Revised**

## Appendix A

### BoreAid HDD Simulation Output



## Generated Output



**WARNING:** The accuracy of the data obtained by the BoreAid® system is highly dependent upon accurate data gathering, data input and proper use of the software. Vermeer is not responsible for that information. BoreAid® data is not intended to replace the need for future on-site utility locating, measuring and verification procedures, which are essential for accurate placement of new underground installations and avoidance of existing utilities.

### CALL YOUR ONE-CALL SYSTEM FIRST



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Locate utilities before drilling. Call 811 (U.S. only) or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.

Before you start any digging project, do not forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call Systems International, contact the appropriate utility companies or national regulating authority to locate and mark the underground installations. If you do not call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or experience job delays.

OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.



## Project Summary

General: Kiewit - CHPE  
Ref: New York  
204-3701  
Start Date: 05-24-2024  
End Date: 09-10-2024

Designer: Aaron Coady  
Tetra Tech Rooney  
115 Inverness Drive East, Suite 300  
Englewood, Colorado  
United States 80112  
aaron.coady@tetrattech.com

Description: Segment 10 (Package 6)  
Conduit 1  
HDD 111.A.A  
DWG C-324.1

## Input Summary

Start Coordinate	(0.00, 0.00, 125.79) ft
End Coordinate	(750.00, 0.00, 125.63) ft
Project Length	750.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

## Soil Summary

Number of Layers: 4

Soil Layer #1 USCS, Sand (S), SM

Depth: 1.00 ft

Unit Weight: 15.6618 (dry), 17.7639 (sat) [lb/US (liquid) gallon]

Phi: 30.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #2 USCS, Silt (M), ML

Depth: 6.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 10.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #4 USCS, Clay (C), CL

Depth: 30.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

**Bend radius < 350.0 ft - 0 Locations**

Length = 750.0 ft

Bore Entry:  $-12.0^\circ$

Bore Exit (target):  $10.0^\circ$

Length = 94.0 ft

Radius = 1000.0 ft  
Arc Length = 209.4 ft

Max. Depth = 47.1 ft

Radius = 1000.0 ft  
Arc Length = 174.5 ft

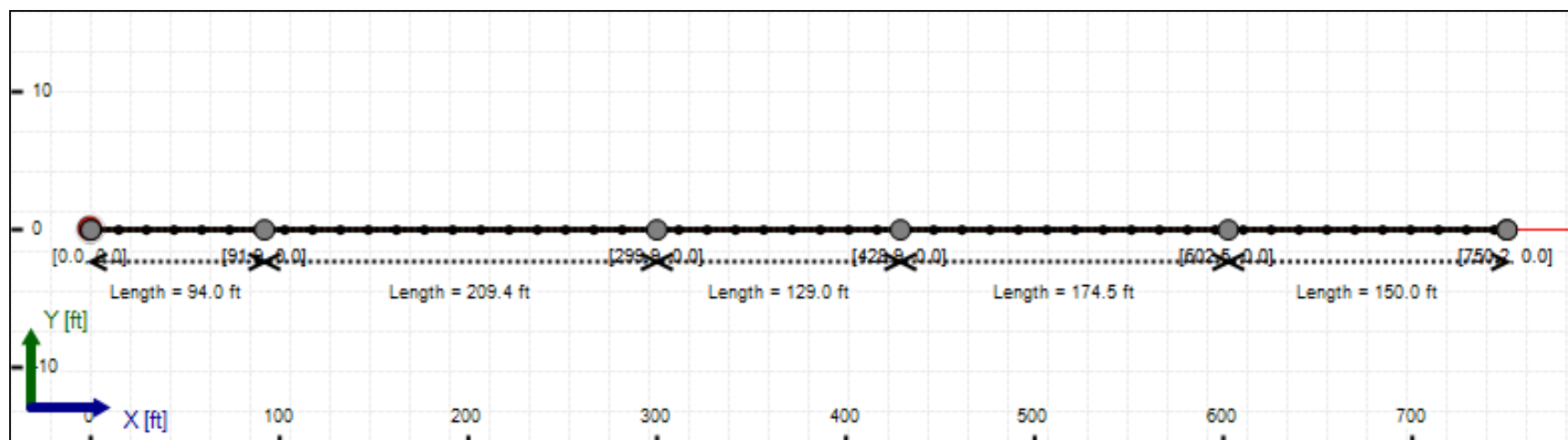
Length = 129.0 ft

Length = 150.0 ft

Z [ft]

X [ft]

## Bore Plan View





## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 10" (10.75")  
Pipe DR: 9  
Pipe Length: 765.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 1.34400002161662 ft  
Silo Width: 1.34400002161662 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	18.2	26.0
Water Pressure	13.7	13.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	31.9	39.7
<b>Deflection</b>		
Earth Load Deflection	4.951	7.078
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	5.083	7.210
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	143.5	178.6

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	13329.7	13329.7
Pullback Stress [psi]	371.7	371.7
Pullback Strain	6.465E-3	6.465E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	371.7	396.4
Tensile Strain	6.465E-3	7.343E-3

Net External Pressure = 23.0 [psi ]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

### In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	5.083	7.5	1.5	OK
Unconstrained Collapse [psi]	31.9	87.7	2.8	OK
Compressive Wall Stress [psi]	143.5	1150.0	8.0	OK

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	37.7	233.8	6.2	OK
Tensile Stress [psi]	396.4	1200.0	3.0	OK

## Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.75 in	86.085 psi	80.089 psi
1	8.75 in	12.00 in	86.035 psi	80.006 psi
2	12.00 in	16.13 in	85.949 psi	79.864 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

## Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
Yes	600	37
Yes	300	32
No	200	29
No	100	25
No	6	17
No	3	15

Flow Rate (Q): 70.00 US (liquid) gallon/min

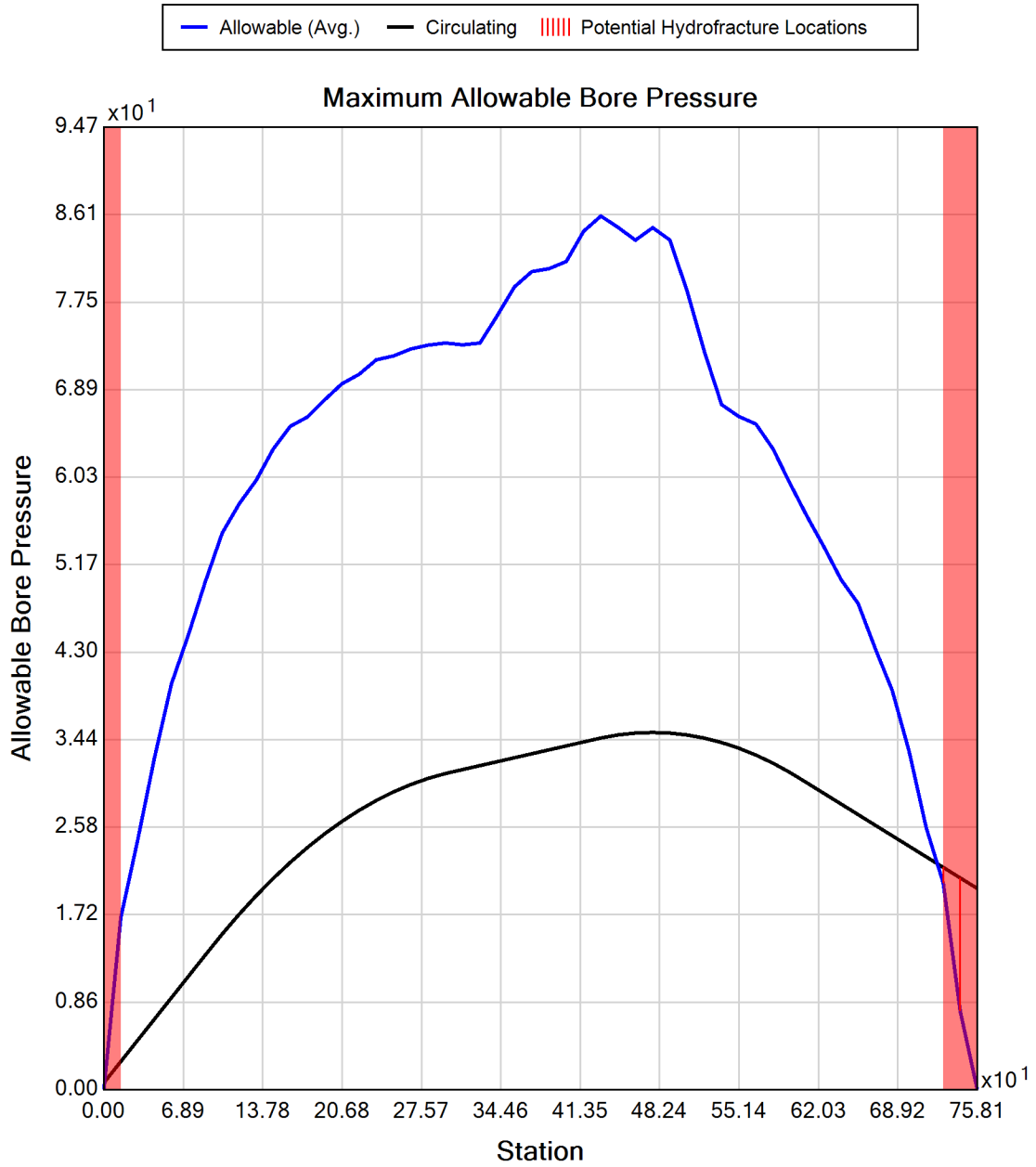
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 5.00

Yield Point (YP): 27.00

Effective Viscosity (cP): 1601.0







## Generated Output



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OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

## Project Summary

General:

Kiewit - CHPE  
Ref: New York  
204-3701  
Start Date: 08-06-2024  
End Date: 09-10-2024

Designer:

Aaron Coady  
Tetra Tech Rooney  
115 Inverness Drive East, Suite 300  
Englewood, Colorado  
United States 80112  
aaron.coady@tetrattech.com

Description:

Segment 10 (Package 6)  
Conduit 2  
HDD 111.A.A  
DWG C-324.1A

## Input Summary

Start Coordinate	(0.00, 0.00, 126.50) ft
End Coordinate	(750.00, 0.00, 125.76) ft
Project Length	750.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

## Soil Summary

Number of Layers: 4

Soil Layer #1 USCS, Sand (S), SM

Depth: 1.00 ft

Unit Weight: 15.6618 (dry), 17.7639 (sat) [lb/US (liquid) gallon]

Phi: 30.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #2 USCS, Silt (M), ML

Depth: 6.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 10.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

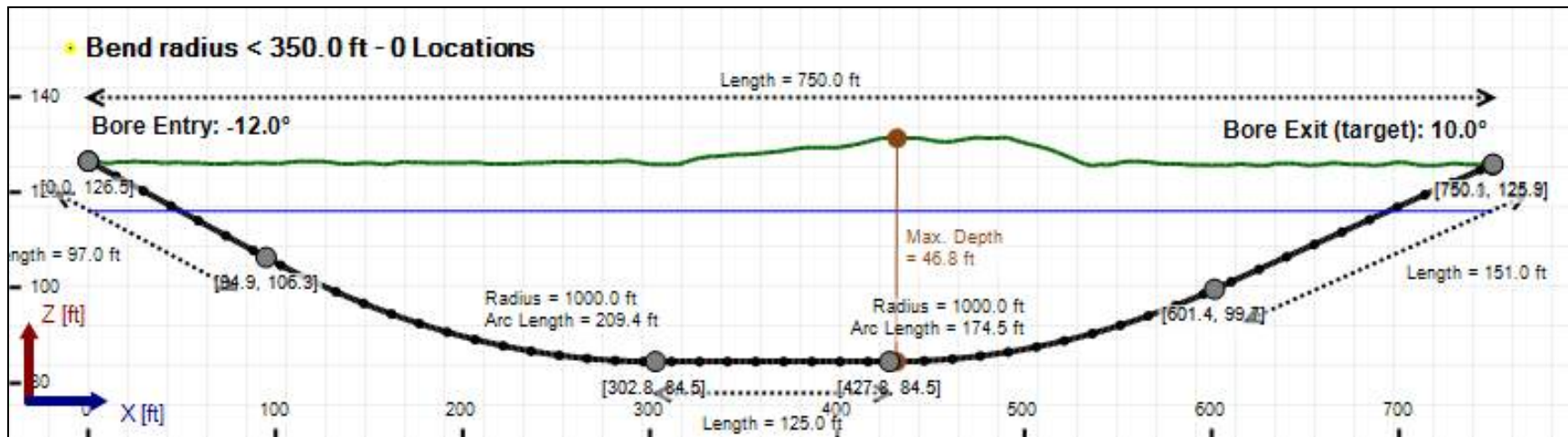
Soil Layer #4 USCS, Clay (C), CL

Depth: 30.00 ft

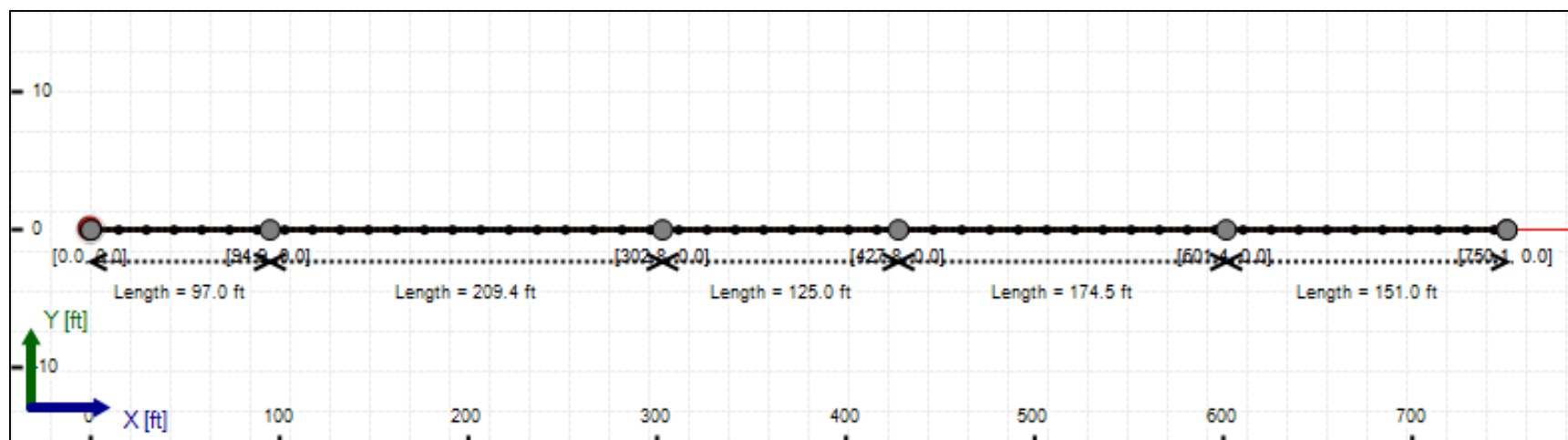
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

## Bore Cross-Section View



## Bore Plan View





## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 10" (10.75")  
Pipe DR: 9  
Pipe Length: 765.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 1.34400002161662 ft  
Silo Width: 1.34400002161662 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	20.1	25.8
Water Pressure	13.7	13.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	33.8	39.4
<b>Deflection</b>		
Earth Load Deflection	5.478	7.020
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	5.610	7.152
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	152.0	177.5

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	13322.8	13322.8
Pullback Stress [psi]	371.6	371.6
Pullback Strain	6.462E-3	6.462E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	371.6	396.5
Tensile Strain	6.462E-3	7.344E-3

Net External Pressure = 22.7 [psi ]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

### In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	5.610	7.5	1.3	OK
Unconstrained Collapse [psi]	33.8	83.7	2.5	OK
Compressive Wall Stress [psi]	152.0	1150.0	7.6	OK

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	37.8	233.8	6.2	OK
Tensile Stress [psi]	396.5	1200.0	3.0	OK

## Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.75 in	84.729 psi	79.835 psi
1	8.75 in	12.00 in	84.679 psi	79.751 psi
2	12.00 in	16.13 in	84.593 psi	79.608 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

## Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
Yes	600	37
Yes	300	32
No	200	29
No	100	25
No	6	17
No	3	15

Flow Rate (Q): 70.00 US (liquid) gallon/min

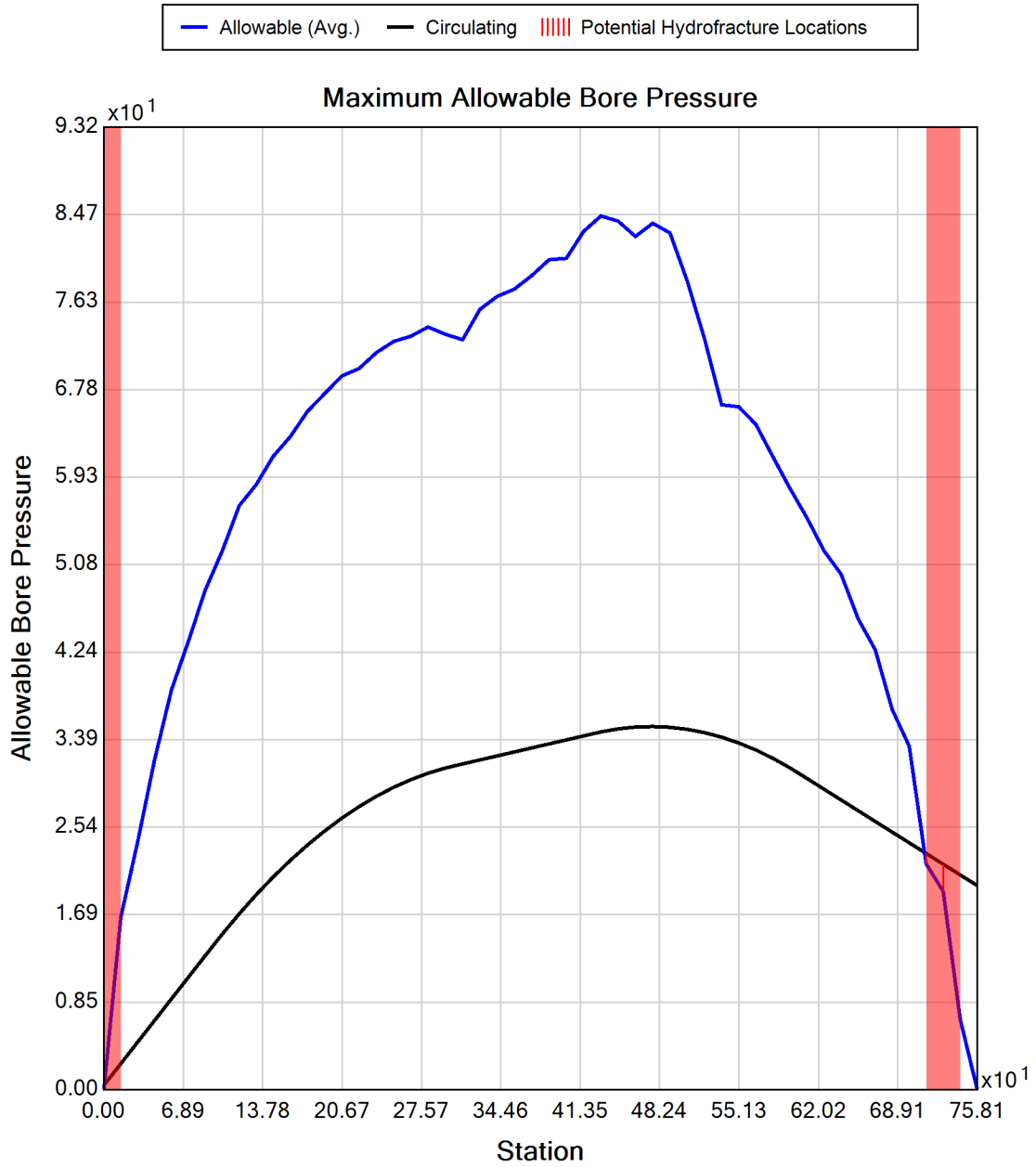
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 5.00

Yield Point (YP): 27.00

Effective Viscosity (cP): 1601.0





## Generated Output



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## Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 05-24-2024 End Date: 09-10-2024
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 10 (Package 6) Conduit 3 HDD 111.A.A DWG C-324.1

## Input Summary

Start Coordinate	(0.00, 0.00, 125.79) ft
End Coordinate	(750.00, 0.00, 125.63) ft
Project Length	750.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	3.500 in
Pipe DR	9.0
Pipe Thickness	0.39 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

## Soil Summary

Number of Layers: 4

Soil Layer #1 USCS, Sand (S), SM

Depth: 1.00 ft

Unit Weight: 15.6618 (dry), 17.7639 (sat) [lb/US (liquid) gallon]

Phi: 30.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #2 USCS, Silt (M), ML

Depth: 6.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 10.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #4 USCS, Clay (C), CL

Depth: 30.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

**Bore Entry: -12.0°**

**Bore Exit (target): 10.0°**

Length = 750.0 ft

Length = 94.0 ft

Length = 129.0 ft

Length = 150.0 ft

Radius = 1000.0 ft

Arc Length = 209.4 ft

Radius = 1000.0 ft

Arc Length = 174.5 ft

Radius = 1000.0 ft

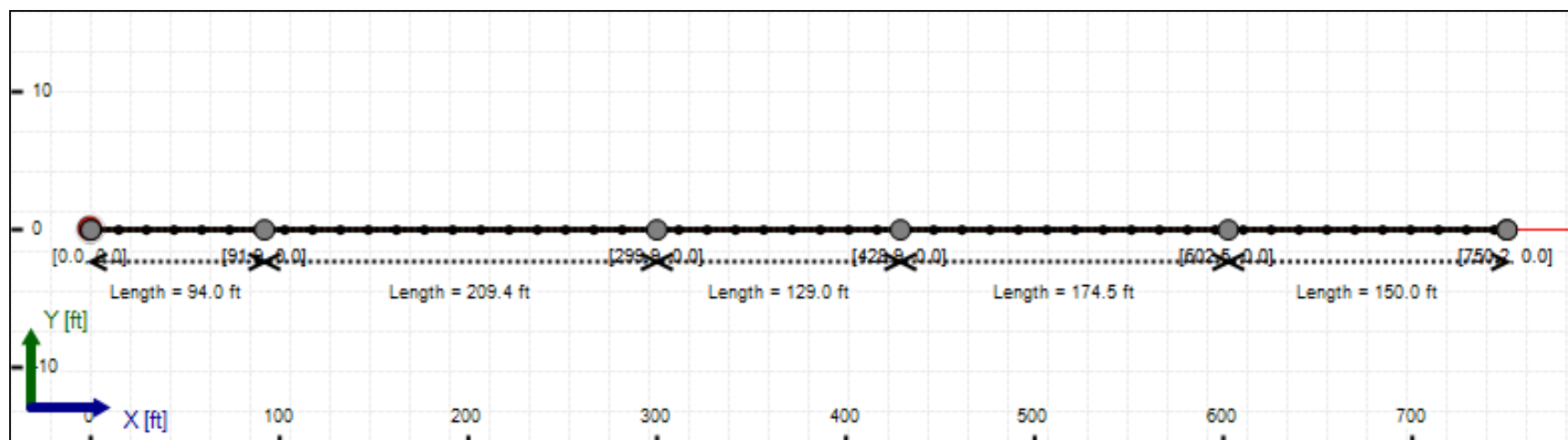
Arc Length = 174.5 ft

Max. Depth = 47.1 ft

Coordinates: [125.8, 125.8], [91.9, 106.2], [299.9, 84.4], [428.9, 84.4], [602.5, 99.6], [750.2, 125.6]

Coordinate System: Z [ft] (vertical), X [ft] (horizontal)

## Bore Plan View



## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 3" (3.5")  
Pipe DR: 9  
Pipe Length: 765.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 0.625 ft  
Silo Width: 0.625 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon



### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	15.4	26.0
Water Pressure	13.7	13.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	29.1	39.7
<b>Deflection</b>		
Earth Load Deflection	4.183	7.078
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	4.226	7.121
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	130.8	178.6

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1525.6	1525.6
Pullback Stress [psi]	401.4	401.4
Pullback Strain	6.980E-3	6.980E-3
Bending Stress [psi]	0.0	8.4
Bending Strain	0	1.458E-4
Tensile Stress [psi]	401.4	408.7
Tensile Strain	6.980E-3	7.254E-3

Net External Pressure = 23.0 [psi ]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

### In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	4.226	7.5	1.8	OK
Unconstrained Collapse [psi]	29.1	94.7	3.3	OK
Compressive Wall Stress [psi]	130.8	1150.0	8.8	OK

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	37.7	233.9	6.2	OK
Tensile Stress [psi]	408.7	1200.0	2.9	OK

## Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.75 in	86.085 psi	80.089 psi
1	8.75 in	12.00 in	86.035 psi	80.006 psi
2	12.00 in	16.13 in	85.949 psi	79.864 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertent returns.

## Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
Yes	600	37
Yes	300	32
No	200	29
No	100	25
No	6	17
No	3	15

Flow Rate (Q): 70.00 US (liquid) gallon/min

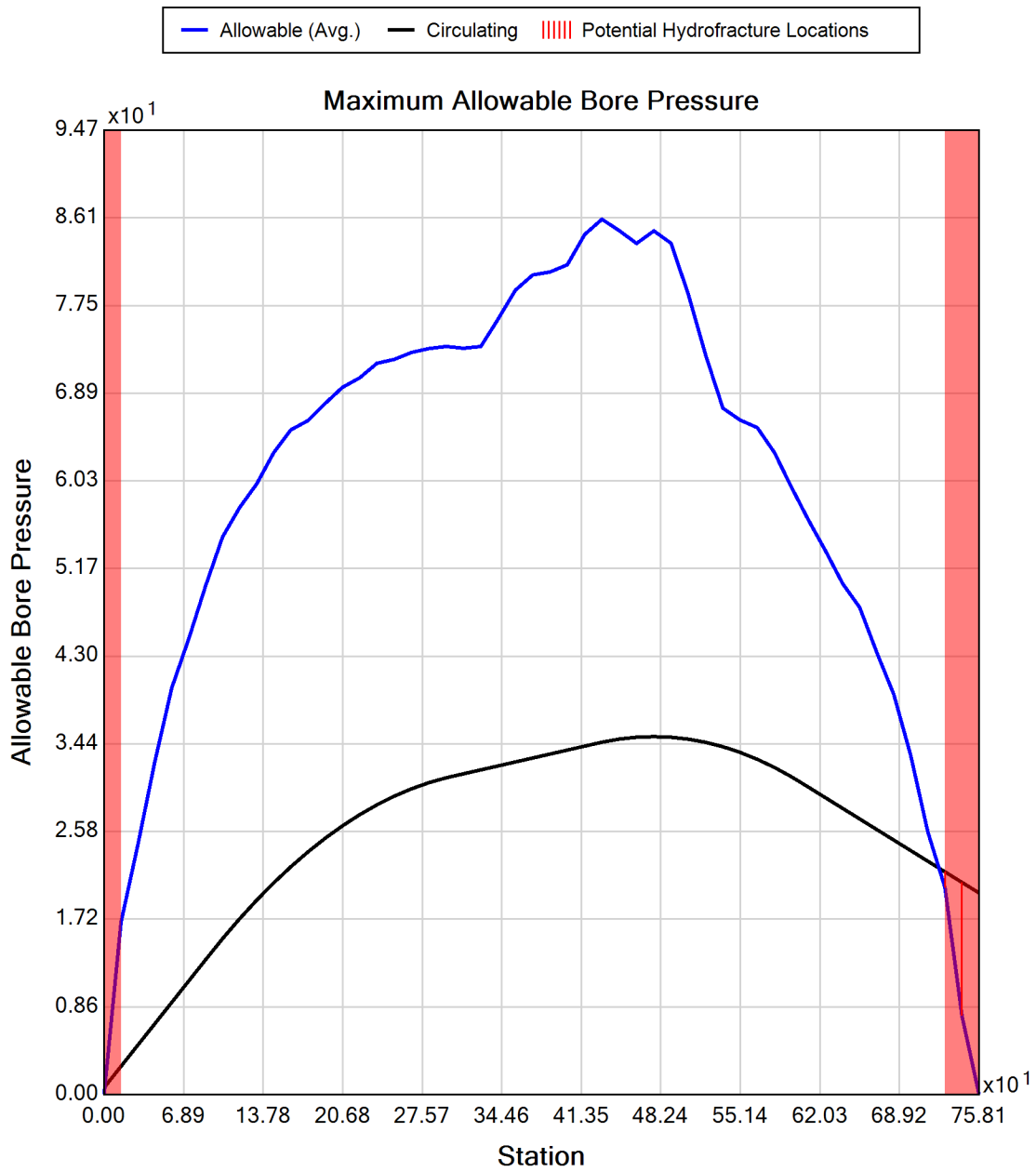
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 5.00

Yield Point (YP): 27.00

Effective Viscosity (cP): 1601.0





## Generated Output



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## Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 05-24-2024 End Date: 09-10-2024
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 10 (Package 6) Conduit 1 & 3 Equivalent Pipe Bundle HDD 111.A.A DWG C-324.1



## Input Summary

Start Coordinate	(0.00, 0.00, 125.79) ft
End Coordinate	(750.00, 0.00, 125.63) ft
Project Length	750.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	11.305 in
Pipe DR	8.5
Pipe Thickness	1.33 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 11.305 in  
Pipe DR: 8.5  
Pipe Length: 765.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 1.4129999478658 ft  
Silo Width: 1.4129999478658 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	18.3	26.0
Water Pressure	13.7	13.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	32.0	39.7
<b>Deflection</b>		
Earth Load Deflection	4.110	5.832
Buoyant Deflection	0.117	0.117
Reissner Effect	0	0
Net Deflection	4.227	5.949
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	136.1	168.7

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	14589.1	14589.1
Pullback Stress [psi]	350.0	350.0
Pullback Strain	6.088E-3	6.088E-3
Bending Stress [psi]	0.0	27.1
Bending Strain	0	4.710E-4
Tensile Stress [psi]	350.0	376.3
Tensile Strain	6.088E-3	7.016E-3

Net External Pressure = 23.0 [psi ]

Buoyant Deflection = 0.1

Hydrokinetic Force = 627.2 lb

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.057	7.5	130.7	OK
Unconstrained Collapse [psi]	37.7	285.1	7.6	OK
Tensile Stress [psi]	376.3	1200.0	3.2	OK



## Generated Output



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## Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 05-24-2024 End Date: 09-10-2024
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 10 (Package 6) Conduit 1 HDD 111.A.B DWG C-324.2



## Input Summary

Start Coordinate	(0.00, 0.00, 121.71) ft
End Coordinate	(925.00, 0.00, 117.77) ft
Project Length	925.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

## Soil Summary

Number of Layers: 4

Soil Layer #1 USCS, Clay (C), CH

Depth: 20.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #2 USCS, Clay (C), CL

Depth: 15.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 7.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

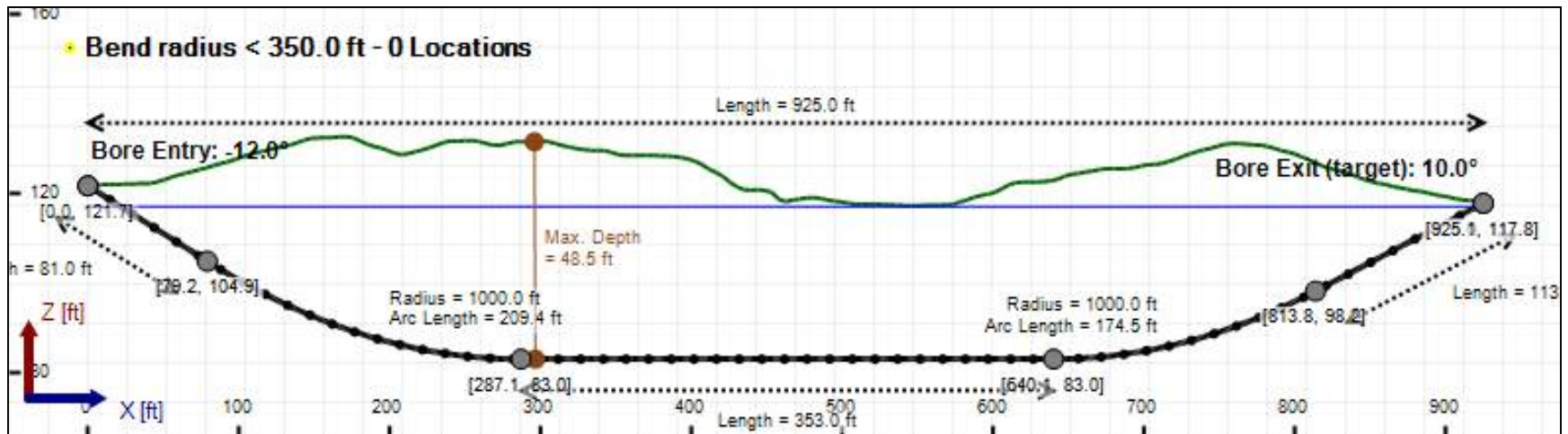
Soil Layer #4 USCS, Silt (M), ML

Depth: 10.00 ft

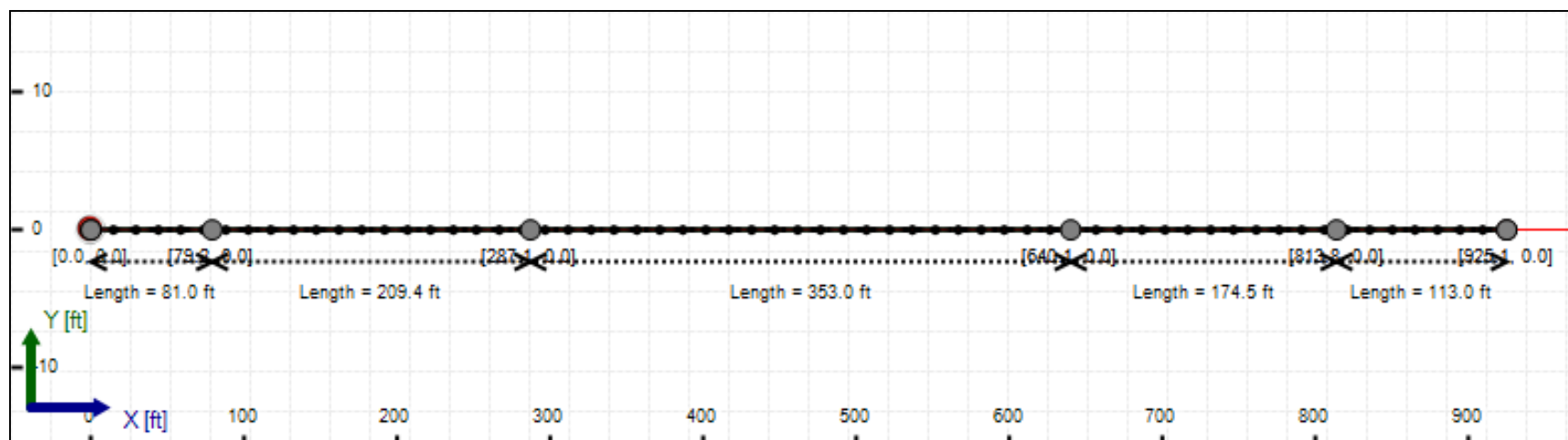
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

## Bore Cross-Section View



## Bore Plan View



## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 10" (10.75")  
Pipe DR: 9  
Pipe Length: 945.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 1.34400002161662 ft  
Silo Width: 1.34400002161662 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	22.9	22.9
Water Pressure	14.7	14.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	37.6	37.6
<b>Deflection</b>		
Earth Load Deflection	6.238	6.238
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	6.370	6.370
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	169.4	169.4

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	15874.0	15874.0
Pullback Stress [psi]	442.7	442.7
Pullback Strain	7.699E-3	7.699E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	442.7	467.0
Tensile Strain	7.699E-3	8.569E-3

Net External Pressure = 20.1 [psi ]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb



### In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	6.370	7.5	1.2	OK
Unconstrained Collapse [psi]	37.6	78.3	2.1	OK
Compressive Wall Stress [psi]	169.4	1150.0	6.8	OK

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	35.2	229.6	6.5	OK
Tensile Stress [psi]	467.0	1200.0	2.6	OK

## Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.75 in	70.538 psi	78.037 psi
1	8.75 in	12.00 in	70.472 psi	77.959 psi
2	12.00 in	16.13 in	70.360 psi	77.826 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

## Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
Yes	600	37
Yes	300	32
No	200	29
No	100	25
No	6	17
No	3	15

Flow Rate (Q): 70.00 US (liquid) gallon/min

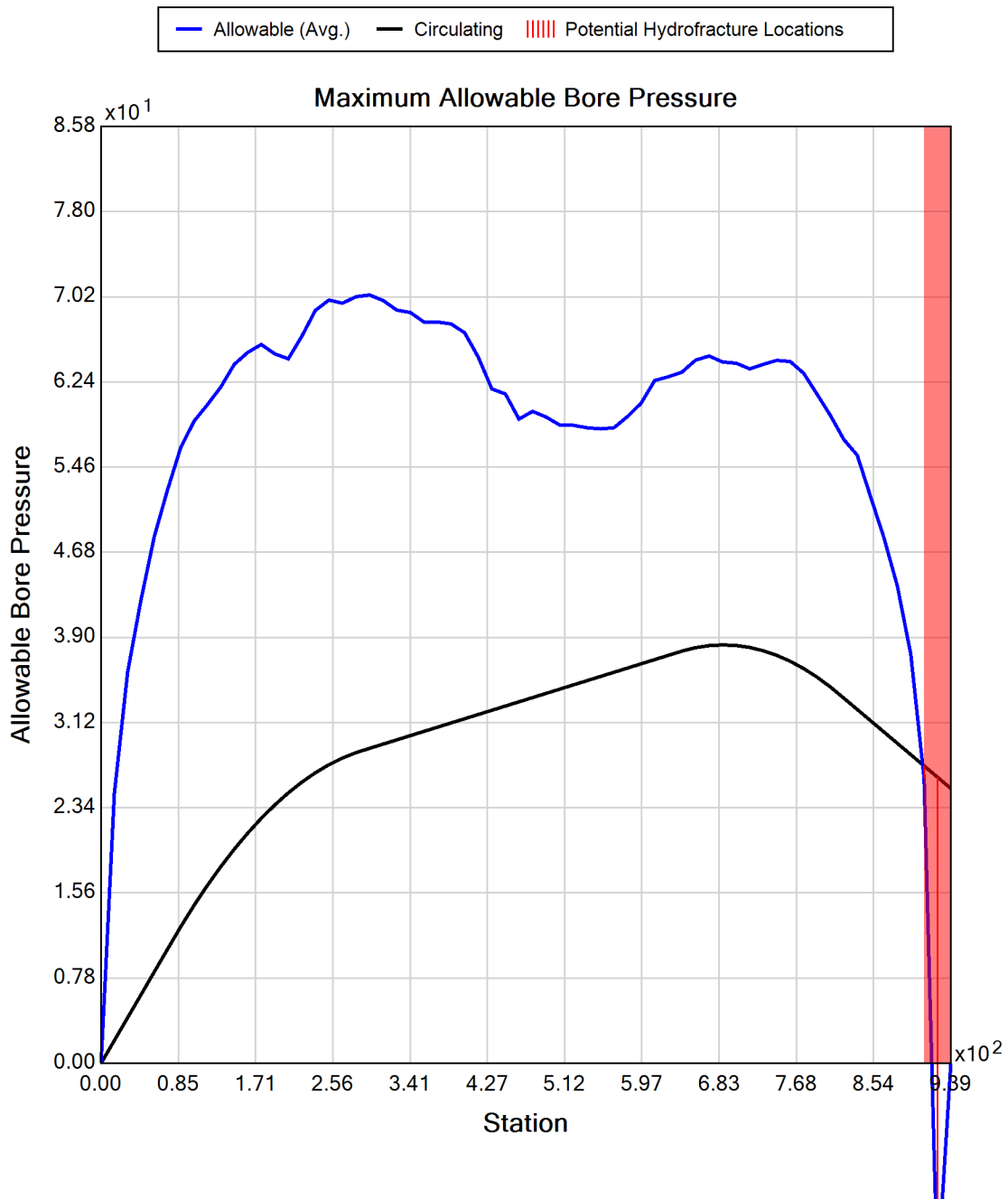
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 5.00

Yield Point (YP): 27.00

Effective Viscosity (cP): 1601.0





## Generated Output



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## Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 05-24-2024 End Date: 09-10-2024
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 10 (Package 6) Conduit 2 HDD 111.A.B DWG C-324.2A

## Input Summary

Start Coordinate	(0.00, 0.00, 122.67) ft
End Coordinate	(935.00, 0.00, 118.77) ft
Project Length	935.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

## Soil Summary

Number of Layers: 4

Soil Layer #1 USCS, Clay (C), CH

Depth: 20.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #2 USCS, Clay (C), CL

Depth: 15.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 7.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #4 USCS, Silt (M), ML

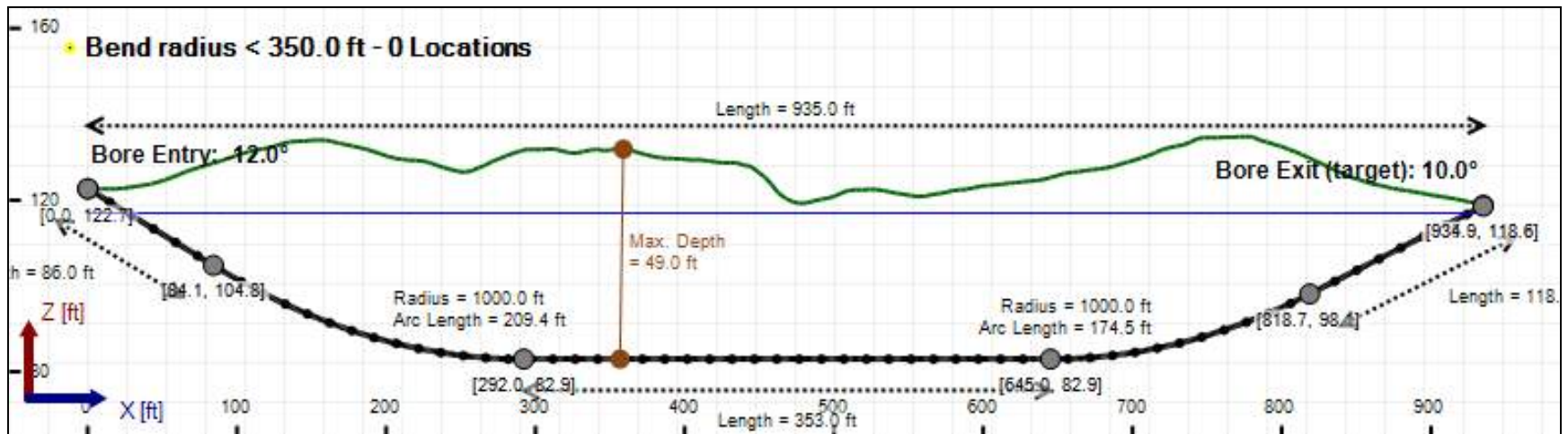
Depth: 10.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

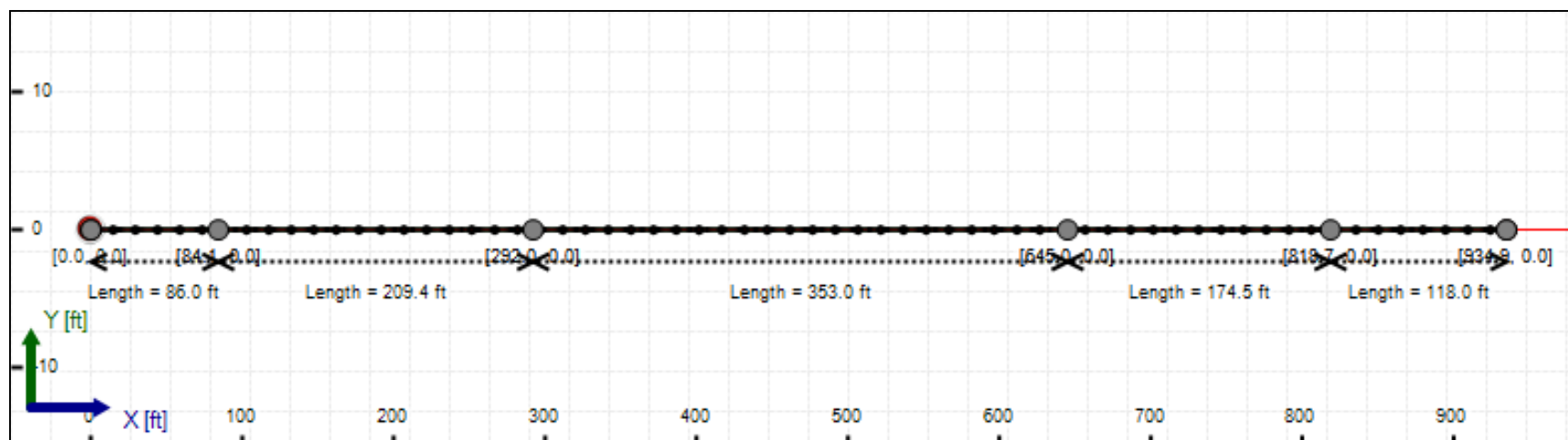
Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]



## Bore Cross-Section View



## Bore Plan View



## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 10" (10.75")  
Pipe DR: 9  
Pipe Length: 945.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 1.34400002161662 ft  
Silo Width: 1.34400002161662 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	23.3	23.3
Water Pressure	14.8	14.8
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	38.0	38.0
<b>Deflection</b>		
Earth Load Deflection	6.336	6.336
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	6.468	6.468
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	171.1	171.1

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	15787.6	15787.6
Pullback Stress [psi]	440.3	440.3
Pullback Strain	7.657E-3	7.657E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	440.3	465.4
Tensile Strain	7.657E-3	8.541E-3

Net External Pressure = 20.1 [psi ]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

### In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	6.468	7.5	1.2	OK
Unconstrained Collapse [psi]	38.0	77.6	2.0	OK
Compressive Wall Stress [psi]	171.1	1150.0	6.7	OK

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	35.8	229.7	6.4	OK
Tensile Stress [psi]	465.4	1200.0	2.6	OK

## Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.75 in	71.008 psi	78.434 psi
1	8.75 in	12.00 in	70.943 psi	78.357 psi
2	12.00 in	16.13 in	70.832 psi	78.227 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

## Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
Yes	600	37
Yes	300	32
No	200	29
No	100	25
No	6	17
No	3	15

Flow Rate (Q): 70.00 US (liquid) gallon/min

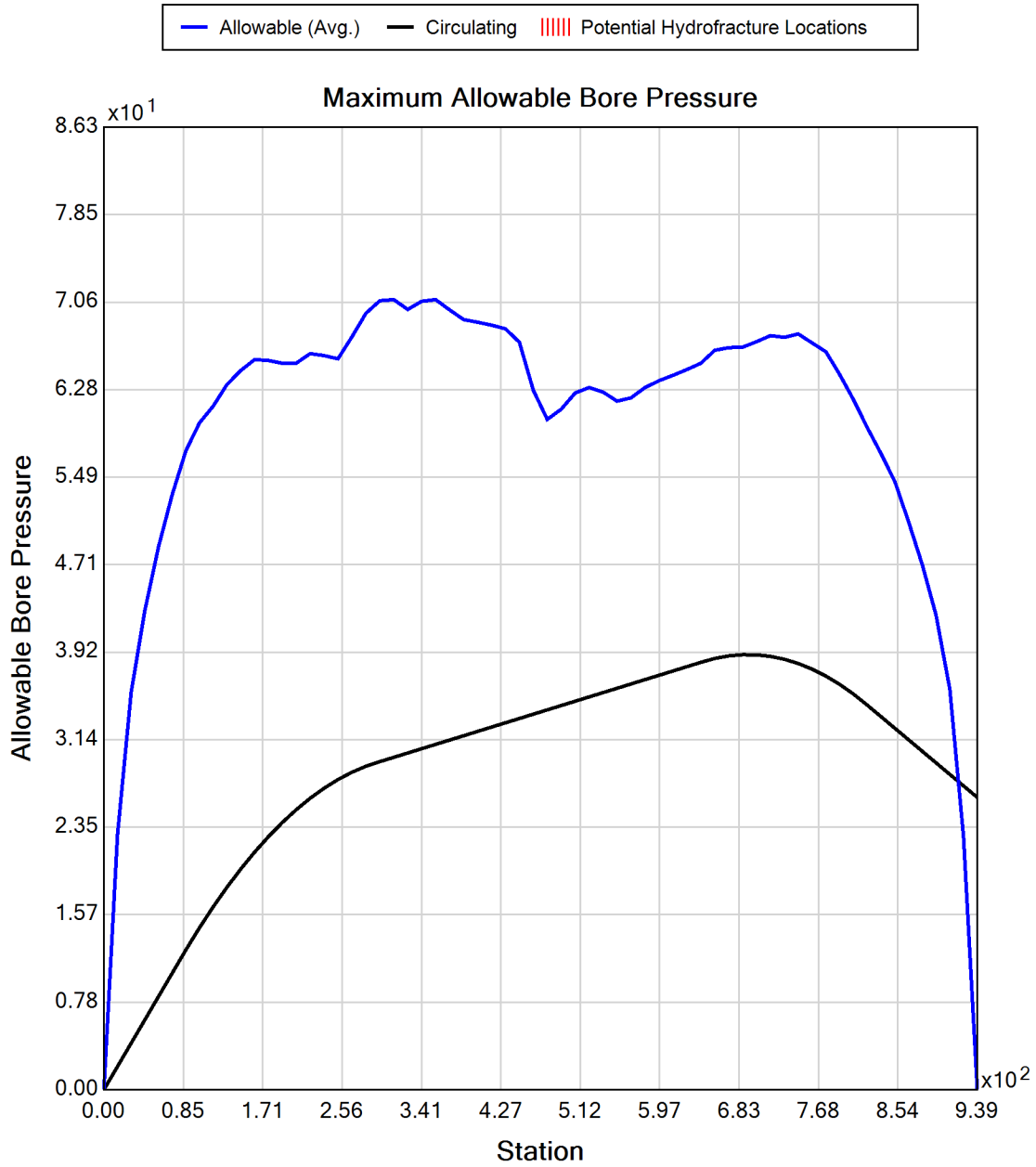
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 5.00

Yield Point (YP): 27.00

Effective Viscosity (cP): 1601.0







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## Project Summary

General:

Kiewit - CHPE  
Ref: New York  
204-3701  
Start Date: 05-24-2024  
End Date: 09-10-2024

Designer:

Aaron Coady  
Tetra Tech Rooney  
115 Inverness Drive East, Suite 300  
Englewood, Colorado  
United States 80112  
aaron.coady@tetrattech.com

Description:

Segment 10 (Package 6)  
Conduit 3  
HDD 111.A.B  
DWG C-324.2

## Input Summary

Start Coordinate	(0.00, 0.00, 121.71) ft
End Coordinate	(925.00, 0.00, 117.77) ft
Project Length	925.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	3.500 in
Pipe DR	9.0
Pipe Thickness	0.39 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

## Soil Summary

Number of Layers: 4

Soil Layer #1 USCS, Clay (C), CH

Depth: 20.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #2 USCS, Clay (C), CL

Depth: 15.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 7.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

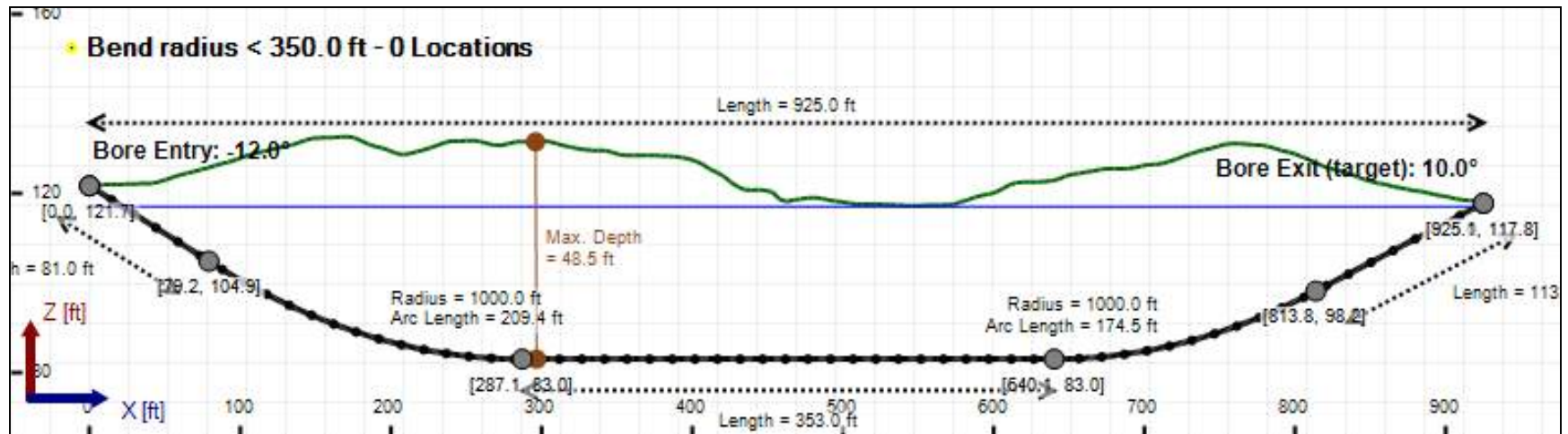
Soil Layer #4 USCS, Silt (M), ML

Depth: 10.00 ft

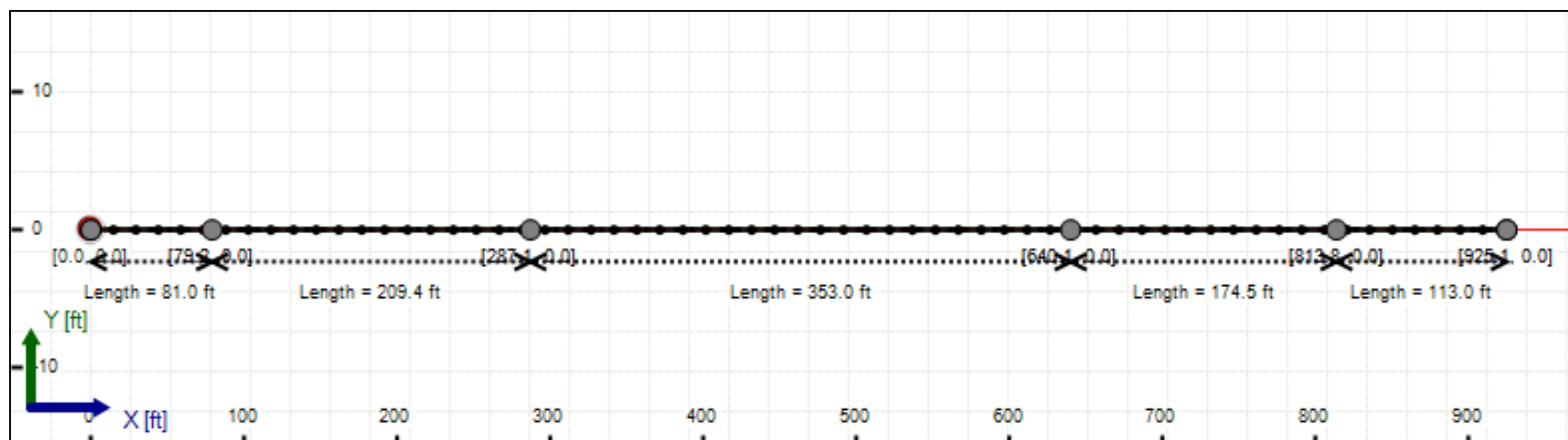
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

## Bore Cross-Section View



## Bore Plan View



## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 3" (3.5")  
Pipe DR: 9  
Pipe Length: 945.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 0.625 ft  
Silo Width: 0.625 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon



### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	22.9	22.9
Water Pressure	14.7	14.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	37.6	37.6
<b>Deflection</b>		
Earth Load Deflection	6.238	6.238
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	6.281	6.281
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	169.4	169.4

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1795.3	1795.3
Pullback Stress [psi]	472.3	472.3
Pullback Strain	8.214E-3	8.214E-3
Bending Stress [psi]	0.0	8.4
Bending Strain	0	1.458E-4
Tensile Stress [psi]	472.3	479.2
Tensile Strain	8.214E-3	8.480E-3

Net External Pressure = 20.1 [psi ]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

### In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	6.281	7.5	1.2	OK
Unconstrained Collapse [psi]	37.6	78.9	2.1	OK
Compressive Wall Stress [psi]	169.4	1150.0	6.8	OK

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	35.2	229.7	6.5	OK
Tensile Stress [psi]	479.2	1200.0	2.5	OK

## Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.75 in	70.538 psi	78.037 psi
1	8.75 in	12.00 in	70.472 psi	77.959 psi
2	12.00 in	16.13 in	70.360 psi	77.826 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

## Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
Yes	600	37
Yes	300	32
No	200	29
No	100	25
No	6	17
No	3	15

Flow Rate (Q): 70.00 US (liquid) gallon/min

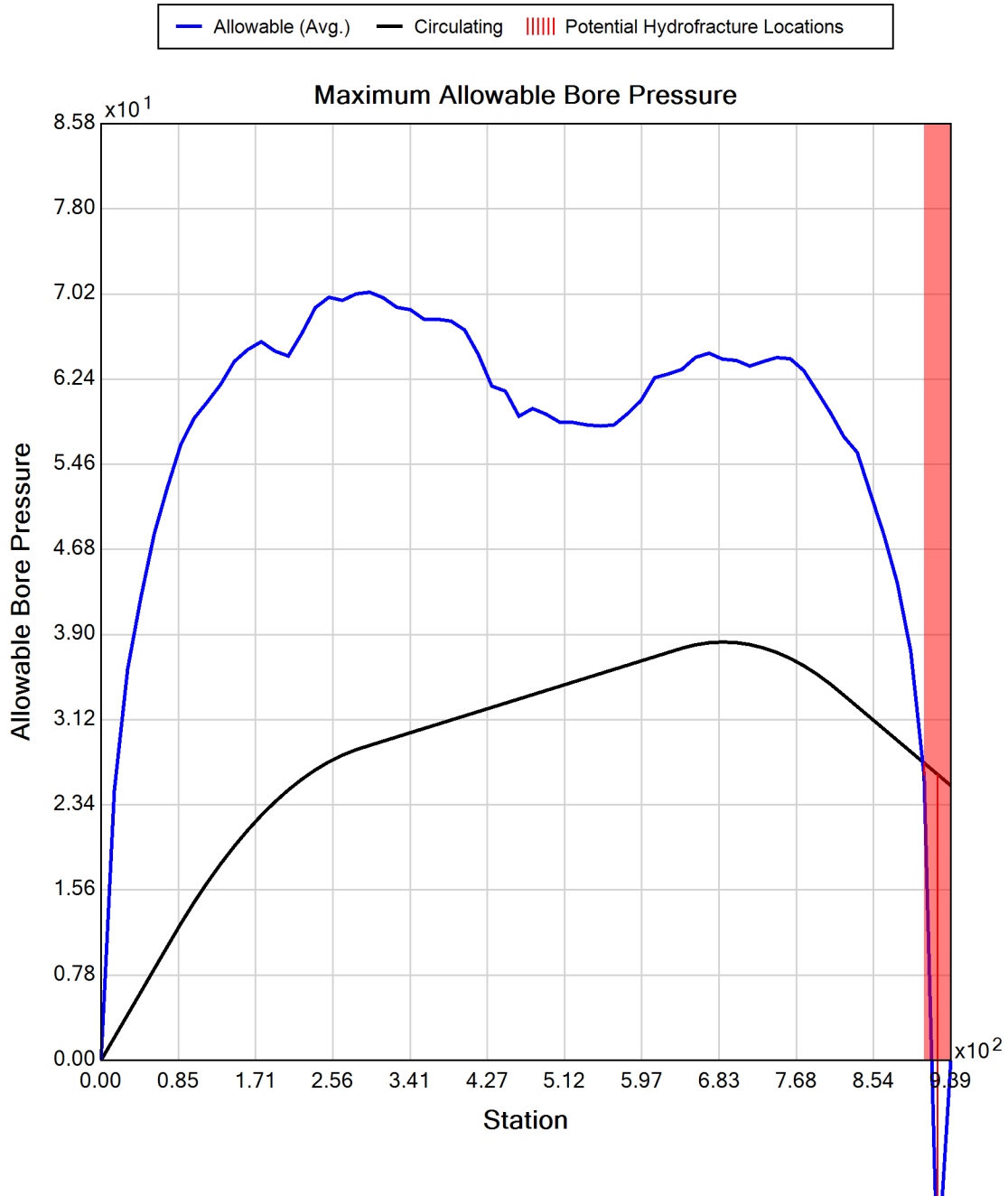
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 5.00

Yield Point (YP): 27.00

Effective Viscosity (cP): 1601.0





## Generated Output



**WARNING:** The accuracy of the data obtained by the BoreAid® system is highly dependent upon accurate data gathering, data input and proper use of the software. Vermeer is not responsible for that information. BoreAid® data is not intended to replace the need for future on-site utility locating, measuring and verification procedures, which are essential for accurate placement of new underground installations and avoidance of existing utilities.

### CALL YOUR ONE-CALL SYSTEM FIRST



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## Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 05-24-2024 End Date: 09-10-2024
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 10 (Package 6) Conduit 1 & 3 Equivalent Pipe Bundle HDD 111.A.B DWG C-324.2

## Input Summary

Start Coordinate	(0.00, 0.00, 121.71) ft
End Coordinate	(925.00, 0.00, 117.77) ft
Project Length	925.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	11.305 in
Pipe DR	8.5
Pipe Thickness	1.33 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft



## Load Verifier Input Summary:

Pipe Application: Electrical Cable  
Pipe Type: HDPE  
Classification: IPS  
Pipe OD: 11.305 in  
Pipe DR: 8.5  
Pipe Length: 945.00 ft  
Internal Pressure: 0 psi  
Borehole Diameter: 1.4129999478658 ft  
Silo Width: 1.4129999478658 ft  
Surface Surcharge: 0 psi  
Short Term Modulus: 57500 psi  
Long Term Modulus: 28200 psi  
Short Term Poisson Ratio: 0.35  
Long Term Poisson Ratio: 0.45  
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon  
Allowable Tensile Stress (Short Term): 1200 psi  
Allowable Tensile Stress (Long Term): 1100 psi  
Allowable Compressive Stress (Short Term): 1150 psi  
Allowable Compressive Stress (Long Term): 1150 psi  
Surface-pipe friction coefficient at entrance: 0.5  
Surface-pipe friction coefficient in borehole: 0.3  
Pipe-soil friction angle: 30  
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon  
Hydrokinetic Pressure: 10 psi  
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

### In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	22.9	22.9
Water Pressure	14.7	14.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	37.6	37.6
<b>Deflection</b>		
Earth Load Deflection	5.140	5.140
Buoyant Deflection	0.117	0.117
Reissner Effect	0	0
Net Deflection	5.257	5.257
<b>Compressive Stress [psi]</b>		
Compressive Wall Stress	160.0	160.0

### Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	17352.7	17352.7
Pullback Stress [psi]	416.3	416.3
Pullback Strain	7.241E-3	7.241E-3
Bending Stress [psi]	0.0	27.1
Bending Strain	0	4.710E-4
Tensile Stress [psi]	416.3	442.3
Tensile Strain	7.241E-3	8.163E-3

Net External Pressure = 20.1 [psi ]

Buoyant Deflection = 0.1

Hydrokinetic Force = 627.2 lb

### Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.057	7.5	130.7	OK
Unconstrained Collapse [psi]	35.2	280.4	8.0	OK
Tensile Stress [psi]	442.3	1200.0	2.7	OK

